A TREATISE ON CARPENTRY.

In which are contain'd the moſt conciſe and authentick

RULES of that ART,

In a more

Exact METHOD than has yet been made publick.

Explain'd by Twenty-Eight Copper-Plates.

By *FRANCIS PRICE.*

LONDON:

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TO THE

RIGHT HONOURABLE

ALGERNON,

Earl of *Hertford*, Baron *Percy*, &c.

My LORD,

YOUR natural Inclination to encourage Arts, makes me preſume to lay this ſmall Treatiſe of Carpentry, at your Lordſhip's Feet; hoping it not unworthy your Patronage, ſince it's a Part belonging to Architecture. And as this Branch of Building has not been ſufficiently

treated of, I have endeavour'd to explain it ſo as to render it uſeful: And wants nothing to recommend it to the World, and ſecure it from Malice and Envy, but the Protection of ſo Noble and Worthy a Patron; and at the ſame Time lay a laſting Obligation on me, who am, with the greateſt Reſpect,

My LORD,

Your Lordſhip's

Moſt Obedient,

And Dutiful Servant,

FRANCIS PRICE.

INTRODUCTION.

AS *all Buildings are compoſed of three principal Heads*, viz. Strength, Uſe, *and* Beauty, *therefore* CARPENTRY *naturally comes in among the Eſſential Heads of* Architecture.

I have uſed my utmoſt Endeavours to render this Treatiſe not only intelligible to Carpenters, *but at the ſame Time to be of Uſe to the ingenious* Theoriſt *in* Building; *and have digeſted it in ſuch a Manner as to need little or no Explanation, otherways than carefully inſpecting the* PLATES.

Nevertheleſs it may not be improper, in this Place, to mention ſome general Obſervations in uſing Timber. There is a Moiſture in all Timber; therefore all Bearing-Timber ought to have a moderate Camber, or Roundneſs: For 'till that Moiſture is in ſome ſort dry'd out, the ſaid Timber will ſag with its own Weight; and that chiefly is the Reaſon, Girders are truſſed, and uſed, as in its Place will be ſhewn. But here obſerve that Girders are beſt truſſed when they are firſt ſawn out, for by its Drying or Shrinking, it tig htens the Truſſes in them yet more.

Obſerve alſo that all Beams, or Ties, be cut, or forced in Framing, to a Camber, or Roundneſs, ſuch as an Inch in the Length of eighteen Feet; and that principal Rafters be alſo cut, or forced up to a Camber, or Roundneſs as before: The Reaſon of this is, All Truſſes, tho' ever ſo well framed, by the Shrinking of the Timber, and Weight of the Covering, will ſag, and ſometimes

ſo

ſo much as to offend the Eye of the Beholder; ſo that by this Preparation your Truſs will ever appear well.

Alſo obſerve that all Caſe-Bays, either in Floors or Roofs, do not exceed twelve Feet if poſſible; that is, do not let your Joiſts in Floors, your Purlins in Roofs, &c. *exceed twelve Feet in their Length, or Bearing; but rather let the Bearing be eight, nine, or ten Feet.*

Alſo in Bridging-Floors, do not place your Binding or Strong-Joiſts above four or five Feet apart; and that your Bridgings or Common-Joiſts are not above twelve Inches apart, that is, between one Joiſt and the other.

Here alſo obſerve, never to make double Tennants or Tenons for Bearing Uſes, ſuch as Binding-Joiſts, Common-Joiſts, or Purlins; for, in the firſt place, it weakens very much whatever you frame it into; and, in the ſecond place, it is a Rarity to have a Draught in both Tenons, that is, to draw your Joint cloſe by the Pin; for the ſaid Pin, by paſſing through both Tenons, if there is a Draught to each, muſt bend it ſo much, that without the Pin be as tough as Wire, it muſt needs break in Driving, and conſequently do more hurt than good.

I hope this will not be ill taken, ſince I do it in order to render the Whole more complete and uſeful, without the leaſt Thoughts of teaching any Man a Trade, my Meaning being only to make ſuch Obſervations as are of general Uſe.

N. B. *All the* PLATES *marked thus,* *, *are to ſhew, that at my firſt compiling this Treatiſe, I intended no more* PLATES *than thoſe without the ſaid Mark; but ſince, receiving better Encouragement than I at firſt expected, I conceiv'd it neceſſary to join thoſe* PLATES, *in order to render the Whole complete.*

THE

THE

CONTENTS.

PLATE		PAGE
A,	Useful PROPOSITIONS in GEOMETRY,	1, 2, 3, 4, 5
B,	Scarfing and Trussing Timber	6
C,	Proper Mortices and Tenons for different Uses	7
C* D*,	The different Manners of Framing Floors	8
D,	POPE's Method to form Hipp'd Roofs	9
E,	How to reduce Bevel Roofs to Square-Workmanship	10
F,	To lay a Roof (and frame it) in Ledgment	11
F* G,	To frame a Bevel Roof	12
G,	The different Pitches or Slopes of Roofs	13
H,	Various Trusses for Roofs, and other Slopes or Pitches	14
I,	Open Roofs suited to THEATERS	15
K,	Open Cielings for *Saloons*, &c.	16
L,	M Roofs, and how a Roof may extend beyond the Walls	17
M,	Roofs suited to CHURCHES or CHAPELS	18
M* N*,	Trusses of noted BUILDINGS, with Improvements.	
N,	Trusses for Partitions and Timber Fronts	19
N* O*,	The Trusses of a Timber Bridge explain'd	20
O,	To frame large Niches or Domes	21

The CONTENTS.

PLATE		PAGE
P,	Roofs for Cupola's or Lanthorns	22
Q,	Centering for Vaults and Groins	23
R,	The Curvilineal Form of Vaulted Cielings	24
S,	To Fineer a Nich, or Rib it for Plaſtering	25
T,	The Manner of Stairs explain'd	26
U,	Kneelings and Ramps with Fluting-Newels, *&c.*	27
W,	To form Scroles proper for Twiſted Rails	28
X,	To account for, and Square a Twiſted Rail	29
Y,	The Plans and Lengths of Balluſters under a Twiſt	30
Z,	To Square a Rail that ramps on a Circular Plan	31
&,	A TABLE for the Scantlings of Timber	32
	Remarks on the ſaid TABLE	33

AS none of the following Branches of Carpentry can be truly perform'd without ſome Knowledge of Geometry, I therefore begin with a few uſeful Propoſitions,

PROP. A. *To erect a Perpendicular on a Right Line given.*

Let a, b, be the Line. At the Point c, place one Foot of your Compaſſes, with which, being opened at Pleaſure, make the two Touches e, and d. Open your Compaſſes yet wider; ſet one Foot in d, make the Section g; place one Foot in e, make the Section f. Laſtly, from the Point c, and through the Interſection of f, and g, draw the Line c, h; which is perpendicular to the Line a, b, that was given.

PROP. B. *To erect a Perpendicular at the End of a Line.*

Let a, b, be the Line, and f, a Point given; take your Compaſſes, place one Foot in f, the other at Pleaſure, as in h. Remove that Foot from f, to any Part of the Baſe it cuts, as in d. Draw a Line through thoſe two Points d, and h, long enough. Laſtly, with your Compaſſes deſcribe the Arch d, e, g, from the Point h; obſerve where it cuts the ſlope Line, as at c, and draw the Line from the Point f, and through the Interſection, as at c; which is perpendicular to the Baſe given.

PROP. C. *To erect a Perpendicular at the End of a Line, another Way.*

Let a, b, be the Line, and b, its Point given, or End. With a five-foot Rod ſet off from b, to d, four Feet, and from b, to e, three Feet. Laſtly, from d, to e, ſet off five Feet. At the Interſection of e, and f, and to the Point b, draw the Line b, c; which is perpendicular to the Line given. This is uſeful to every one concern'd in Building; and may be done by eight Feet, ſix Feet, and ten Feet; or by ſixteen Feet, twelve Feet, and twenty Feet, each being proved by what Geometricians call the Powers of Numbers; and is thus: Four Times four is ſixteen, and three Times three is nine, which added together makes twenty five;

and ſo is five Times five, twenty five; that is, the Squares of the Baſe and Perpendicular, of all Right-angled Triangles, added together, are equal to the Square of the Hypotheneuſe,

PROP. D. *An acute Angle being given, to take the ſame.*

Let a, b, be a Line given, and b, e, the Line that makes the Angle. Then take from your Scale the Length of four Feet, and place it on the Line a, b, at d, and on b, e, at c. Then take the Diſtance between thoſe two Points d, c, which here ſuppoſe two Feet eight Inches. This Method will take the Angle.

PROP. E. *An obtuſe Angle being given, to take it.*

Let a, b, be ſome Line, and c, d, the Line making the Angle. From c, place three Feet, as at e; alſo from c, place three Feet, as at f. Laſtly, from e, to f, take the Diſtance, which here, is five Feet ſix Inches.

PROP. F. *To deſcribe an Oval to a Length given.*

On a Line, as a, b, place the Length l, m; divide it into three equal Parts; with one, as c, d, make the two Circles; their Interſections give the Place of the Curves Meeting, and alſo the Centers, by which deſcribe the Oval g, h, i, k.

PROP. G. *To deſcribe an Oval to a Length or Width given.*

On a Line, as a, b, make two Equilateral Triangles, not exceeding the Width of the Oval, as c, d, e, and c, d, f, whoſe Sides continued give the Centers and Places of the Sections Meeting, ſo that you may deſcribe an Oval to either the Length or Width, as g, h, i, k.

PROP. H. *To deſcribe an Oval to any Length and Width given.*

On a Line, as a, b, limit your Length, as o, p; alſo your Width, as c, d. Take the Width c, d, in your Compaſſes; place one Foot in o, obſerve how far it cuts on the Baſe, as at e; divide the Diſtance from e, to p, into three equal Parts; with two of them, placed on each Side the Center f, make two Equilateral Triangles, as g, e, i, and g, e, h; whoſe Sides being continued, give the Centers and Places of the Sections Meeting, by which you deſcribe the Oval k, l, m, n. This is of general Uſe; but

more

more particularly to Maſons, and Bricklayers, for in Arches thus deſcrib'd they have Occaſion but for two Moulds.

PROP. I. *To deſcribe an Oval to any Length and Width, by another Method.*

On ſome Line, as a, b, limit the Length of your Oval, as g, h; alſo limit your half Width (or Height) d, c. Take half the Length, as g, d; in c, place one End of your Length; obſerve where that Length g, d, cuts the Baſe, as in e, or f; drive a Nail in each Point: Then with a String you may deſcribe the Oval deſired.

PROP. K. *To deſcribe an Oval by the Meeting of Lines.*

On ſome Line, as a b, make a Circle the Length of your Oval, as a, e, b; alſo make a Circle the Width of your Oval, as f, c, g; divide either into a Number of equal Parts, as here into twenty; lay a ſtreight Rule from the Center to each of theſe Parts; let it touch the Periphery of the other Circle, by which it is divided into twenty Parts alſo. Draw Lines parallel to the Baſe, from the Circle for the Width; and alſo, perpendiculars from thoſe Diviſions on the Circle for the Length. The Meeting of them forms a compleat Oval, as a, c, b.

PROP. L. *To deſcribe an Oval more exactly true than any of the foregoing Methods, with a Trammel.*

Let a, b, repreſent the Length of an Ellipſis or Oval, and d, c, half the Width or Height of the ſame Ellipſis or Oval.

Let the Form of the Trammel be Fig. M.

Let † be the Rod of a Trammel, and * the Groove or Stock of the ſame: Take the Groove *, and fix the Middle thereof, as a, b, on the Baſe Line given in L; alſo obſerve that the Groove d, c, in *, be over the Line d, c, in L. Laſtly, having two Pieces like the Head of a Gage to ſlip on †, and faſten at Pleaſure, the Bottom of which is made a Pin, the exact Bigneſs of the Groove in *, on †, let a, be a Pencil fix'd; take the Half Width of your Oval in L, as c, d, and place the moving Head c, †, to the ſame Diſtance, as a, c; take alſo your

Half Length from L, as a, d; which place from a, the Pencil in †, to d, the other moving Head, as a, d; each being fix'd, move the Rod †, in the Groove *: So will the Pencil a, form the true Curve desired. An Ellipsis so form'd, is agreeable to a Circle in any Position: Such as Groins, or Angle Brackets, without Tracing.

PROP. N. *Part of a Circle being given, to form the Whole.*

Let a, b, c, be the Part of a Circle given. With your Compasses opened at Pleasure, place one Foot on the Curve given in d; describe the Section e, f. Place one Foot, as in i; describe the Section g, h. Remove your Compasses, place one Foot in l, describe the Section m, n; place one Foot in o, describe the Section p, q. Lastly, through the Intersections draw the Lines k, u, and r, p, that meet in s; it is the Center by which you may describe the Circle. This seldom falls out to be used, but is in Fact the same as bringing three Points given, which are not in a right Line, into a Circle.

PROP. O. *A Circle and Tangent Line given, to know its Point of Contact or Touch.*

Let a, b, c, be the Circle given, and d, e, the said Tangent Line. From the Center f, to any Part of the Tangent Line, draw a Line at Pleasure; on which Line form a Semi-Circle to its Extent, and observe where it passes through both, as at g; for that is the Point of Contact or Touch.

PROP. P. *Shewing how to increase or decrease a Scale to any Proportion desired.*

Let a, b, represent one Foot or ten Feet of a Scale by which a Drawing has been perform'd: let the same Drawing be demanded to be contracted, so as to contain one Fourth, or one Half, or three Fourths of the same Bigness in its Superficies. If three Fourths, divide the Line a, b, into four equal Parts, and at 3 raise the Perpendicular c, d; observe where it passes through the Circle first made on the Line: So from a, to d, is a Scale of one Foot, or ten Feet, which will be in the Proportion desired; and from d, to b, will be a Scale one fourth as big; that is,

your

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your Drawing, when perform'd by either of theſe Scales, the Propoſition is demonſtrated.

PROP. Q. *To divide a Circle into ſix equal Parts, or any Number in Progreſſion generated by ſix.*

Let a, f, c, be the Circle given; its Radius, or Semi-Diameter, g c, or g d, will divide it into ſix equal Parts, as d, a, e, f, b, c; by ſubdividing each into two, you have it in twelve; if into three, eighteen; if into four, then your Circle will be in twenty four; and ſo on.

PROP. R. *To divide a Circle into eight Parts, or any Number in Progreſſion generated by eight.*

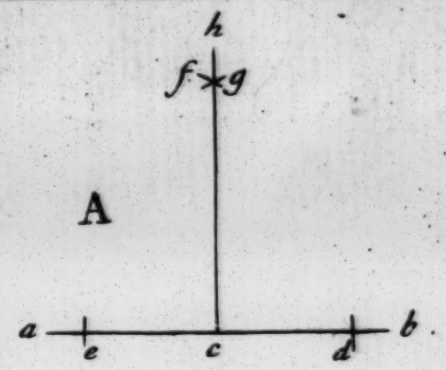
Let a, b, c, d, be a Circle given to be divided into eight equal Parts. Firſt draw the Diameter through the Center, as a, b; at Right Angles draw the Diameter c, d, alſo through the Center; that divides the Circle into four equal Parts; then by ſubdividing each into two, your Circle is divided into eight equal Parts, a, e, d, f, b, g, c, h; by ſubdividing each again into two, you divide the Circle into ſixteen equal Parts; and if again into two, then your Circle will be in thirty two equal Parts; and ſo on.

PROP. S. *To form an Octagon within a Geometrical Square.*

Let a, b, c, d, be the Square given. Draw the diagonal Line a, c, alſo the Diagonal b, d; place one Foot of your Compaſſes, or, if required, one End of a Rod, in a; make the Section e, h, with Half the Diagonal, and remove to b; make the Section g, k; then remove to c; make the Section m, i; remove to d; make the Section f, l. Laſtly, draw Lines from f, to g; and from h, to i; and from k, to l; and from m, to e; ſo is e, f, g, h, i, k, l, m, the Octagon required. And this is ſo uſeful, that every Artificer in Building ought to be acquainted with it.

Plate A.

A



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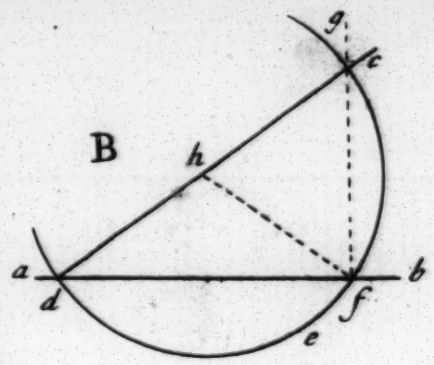

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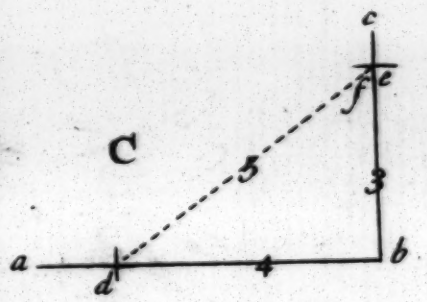

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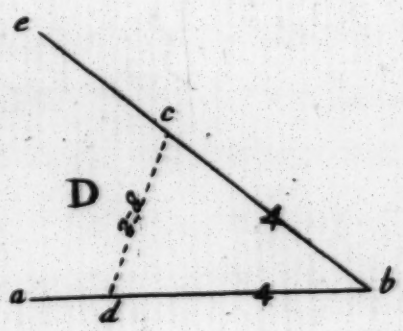

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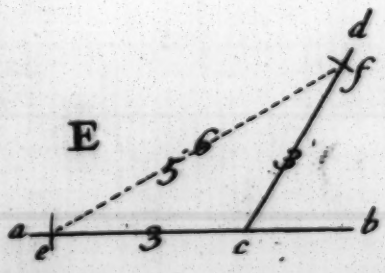

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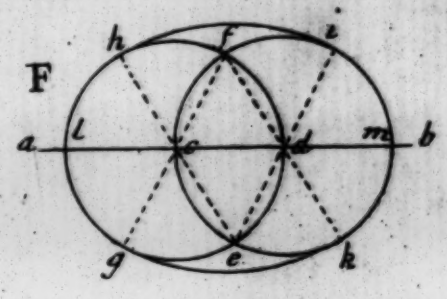

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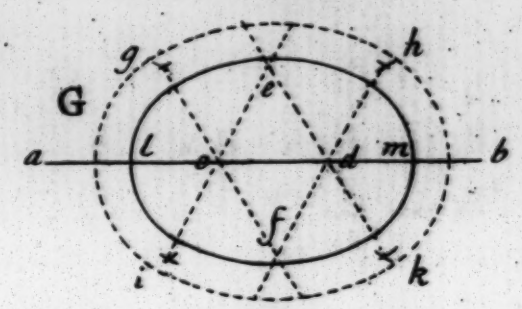

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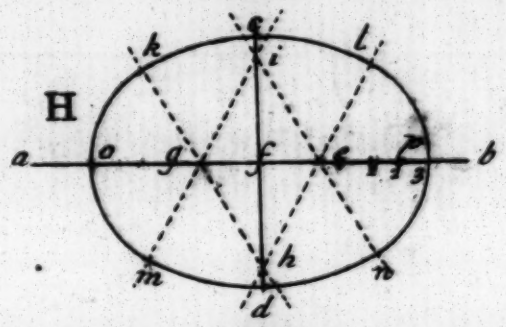

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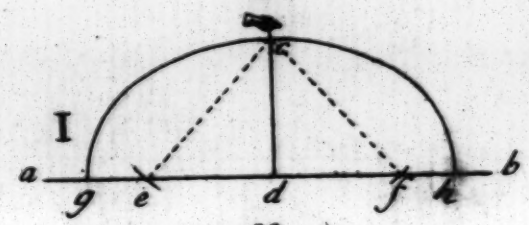

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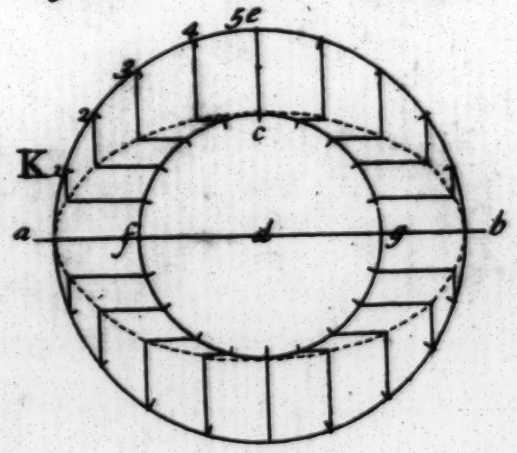

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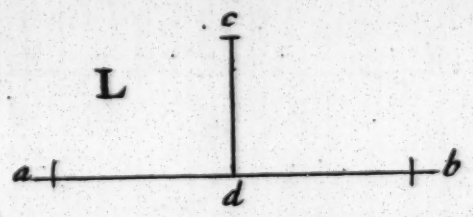

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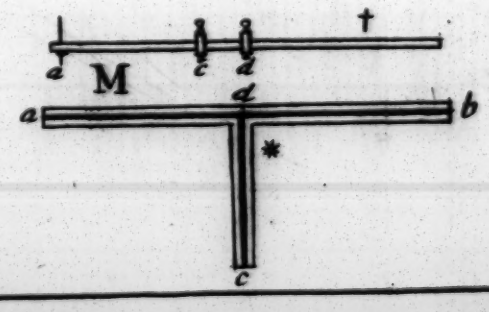

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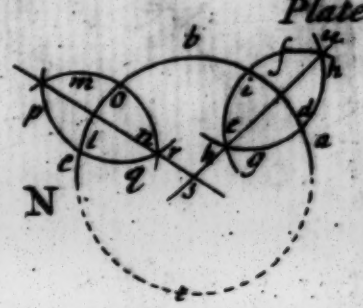

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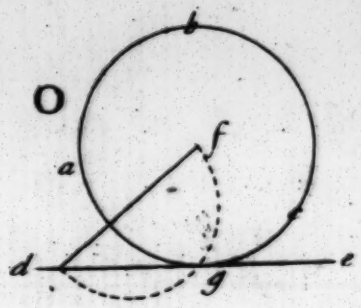

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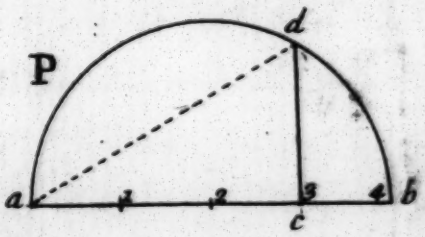

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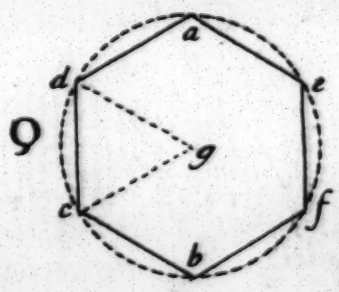

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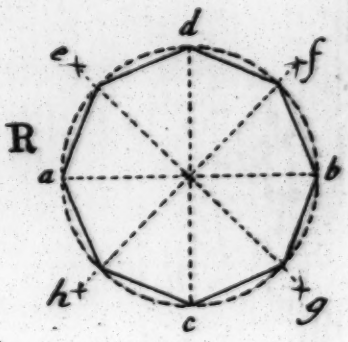

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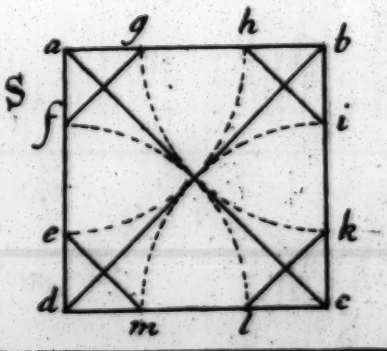


Fran. Price Delin

Toms Sculp.

BECAUSE it is found to be neceſſary here, I have ſhewn the Manner of Scarfing, or Piecing of Timber together.

In a, and b, are ſhewn Joynts for Plates, Lintells, or Timber for Tyes; and if for Beams, add the Bolts, as repreſented in the Figures.

Where more Strength is required, ſee c, d, e, f; which laſt may be done without waſting any of the Length of your Timber, and that of d, for an extraordinary Uſe; for by its being in two Thickneſſes, it may be made as ſtrong as though in one Piece. I do not propoſe to limit the Length of theſe Joynts, but only to ſhew their Form of being framed.

In g, h, i, is ſhewn the Manner of Truſſing Girders that are to bear above twenty four Feet.

Firſt, cut out two Pieces of Timber, which together make the Scantling propoſed, with ſome good, dry, and ſtrait-grain'd *Engliſh* Oak, of four Inches by three, or ſix Inches by four, as the Nature of the Thing ſhall require. Let half into one Piece, as in g, at l, m, n, as tight as it's poſſible to drive them in; then cut a Vacancy in the other Half, as h, which ſhall alſo drive on that of g, as tight End-ways at l, and m, as it's poſſible; laſtly, bolt them together, as is ſhewn above, and they are fit for Uſe.

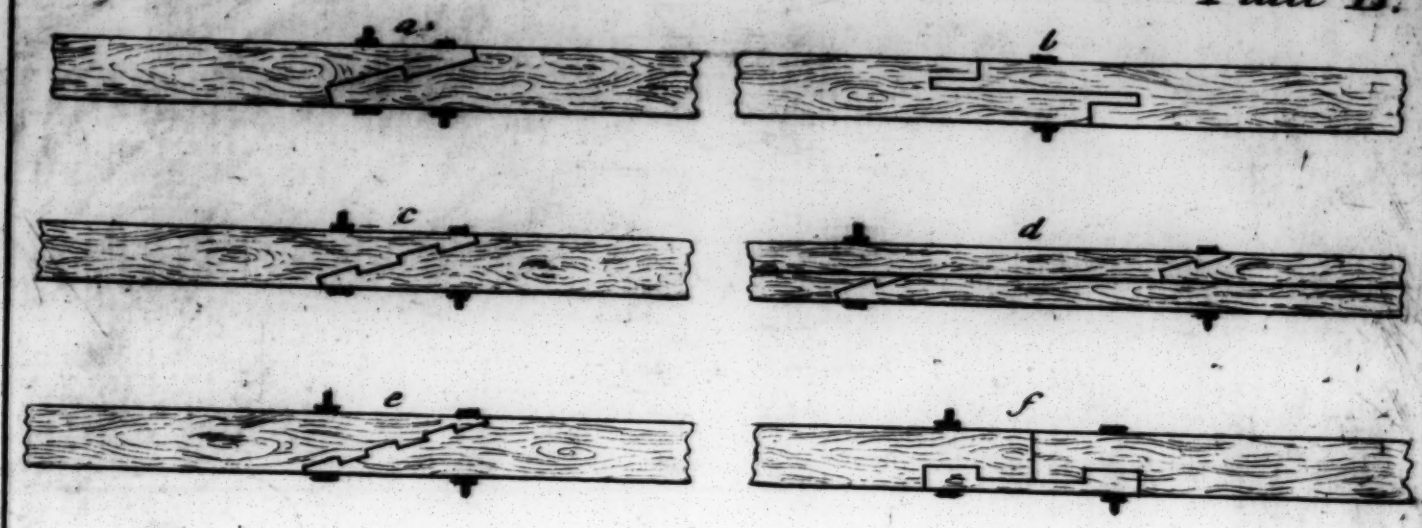
In i, is yet a ſtronger Method, becauſe it divides the Bearing into three equal Parts.

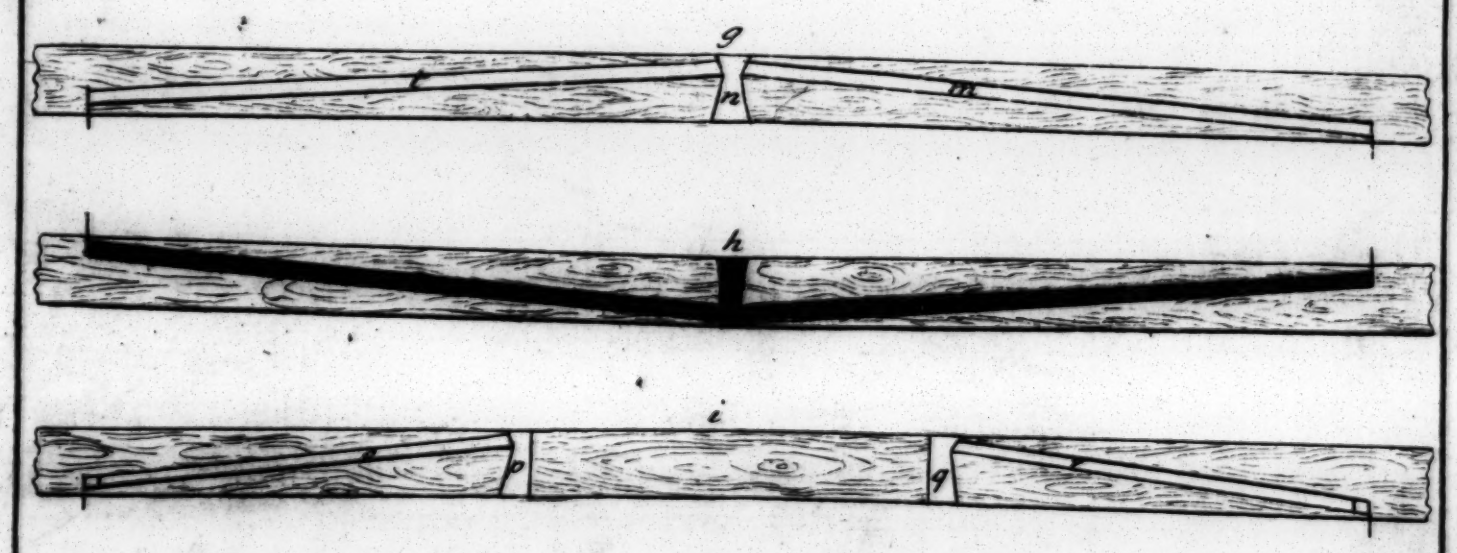
As before, let in the Pieces o, p, q, r; and at the Foot of o, and r, you may mortice through both Flitches, by which you may with a Wedge, tighten the ſaid Girders, when the Building is cover'd in, which Conveniency is worthy of the ſtricteſt Regard.

In k, is the Way propoſed or taught by *Leon Baptiſt Alberti*. Take two Pieces or Flitches, being well dryed, and turn the But-End of the one, to the Top-End of the other without Truſſing at all, and bolt, or ſcrew them together; the ſhort Lines, at the Ends of the Truſs, repreſent the Walls to bear them when done.

In the lower Part of the Plate, appears t, u, s, by which is ſhewn how Timber may be uſed, that is not long enough, and muſt be camber'd at w, x, y; as is ſhewn by z, z.

Plate B.





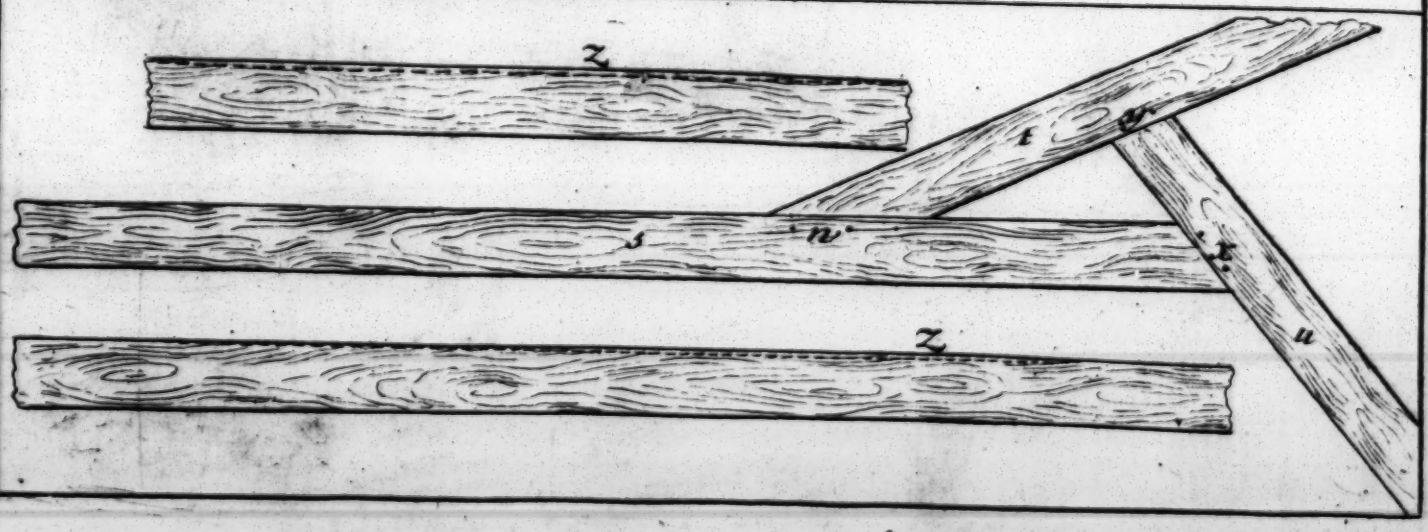
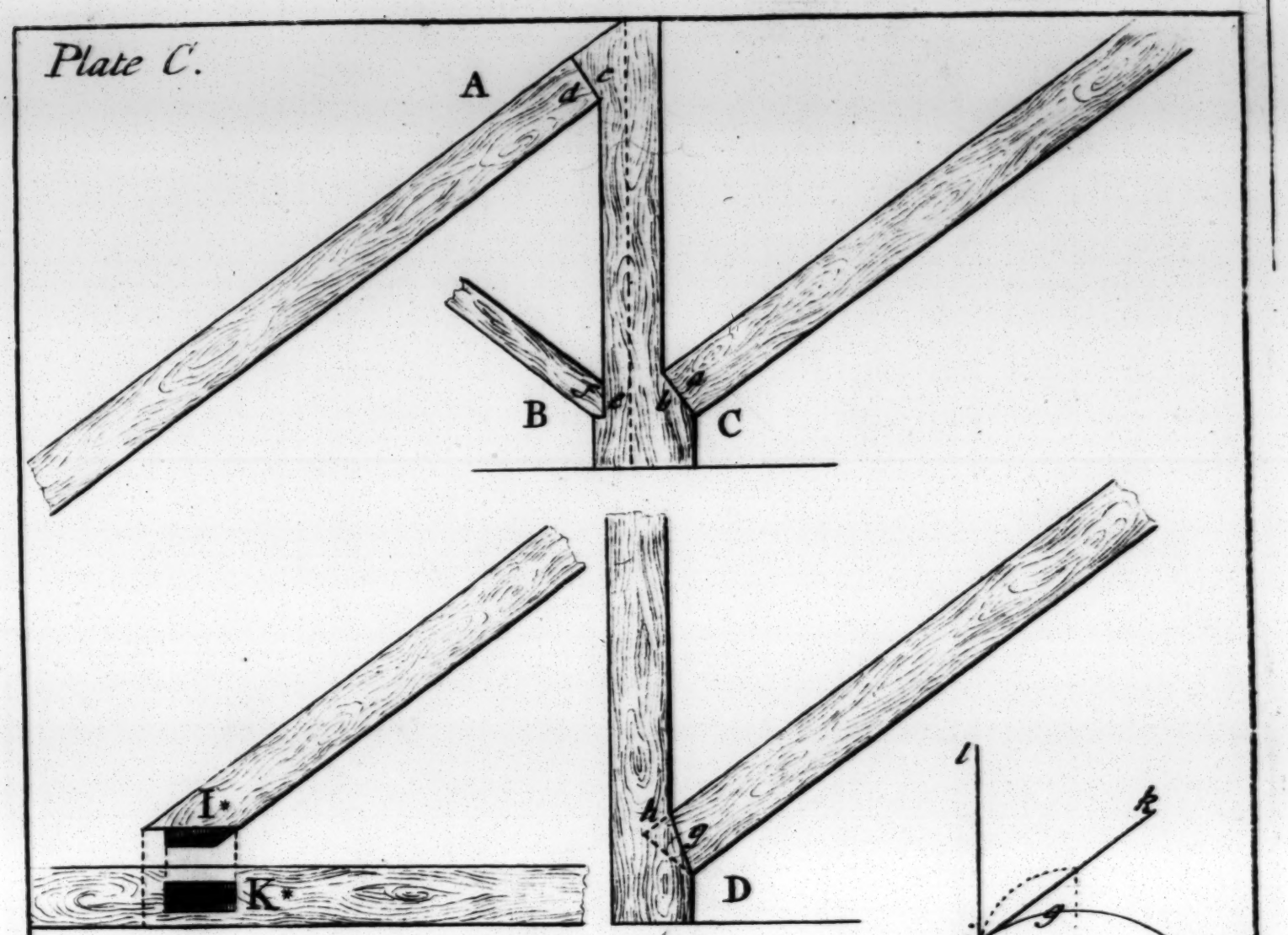
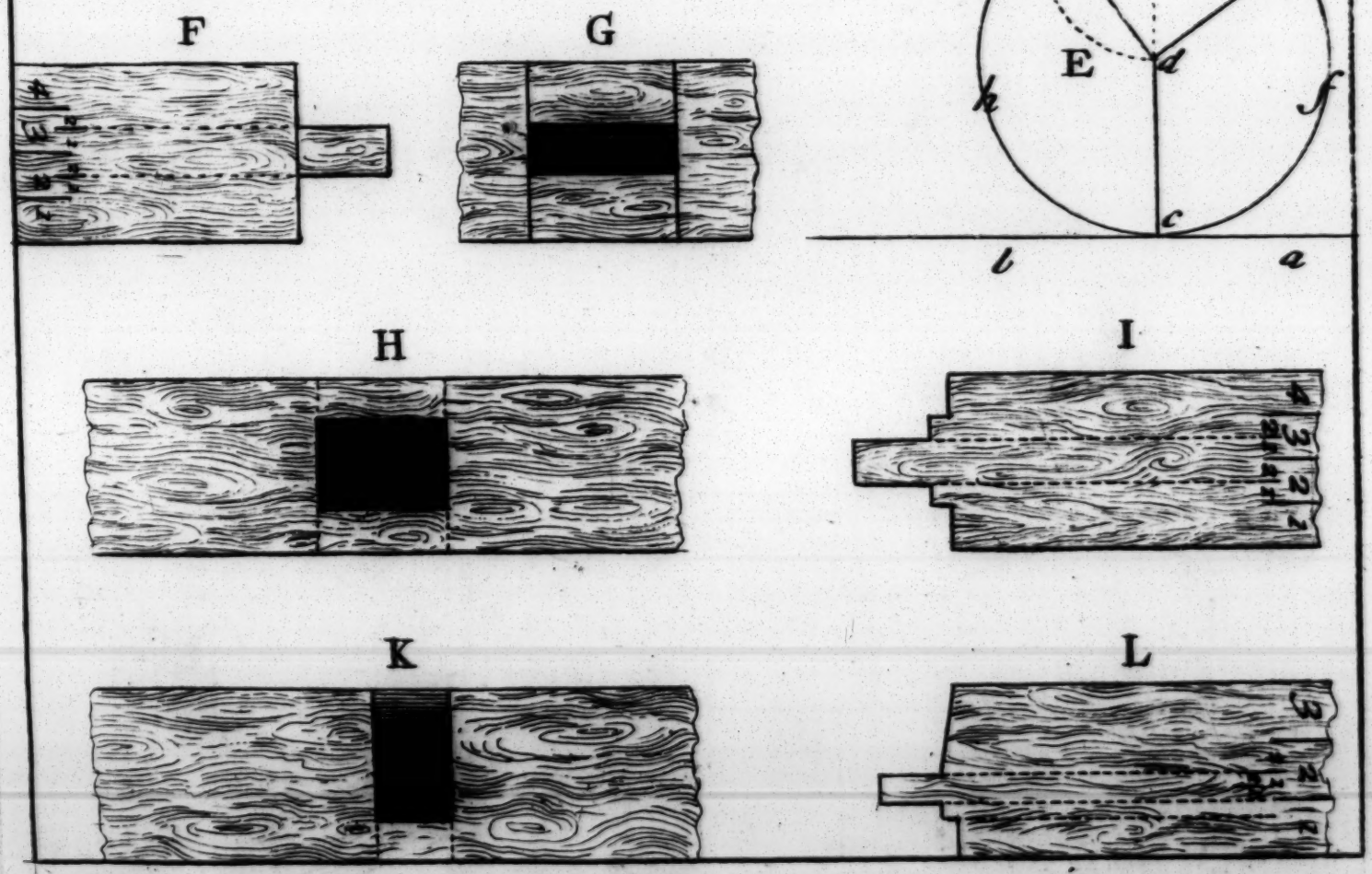


Plate C.





CONSIDERING how uſeful the right and true Way of Framing Timber may be, to ſome of my Readers, I hope this Plate may not be unſeaſonably applyed, ſince none of the following Parts can be perform'd without a juſt Knowledge of it.

At A, is the Joynt of a principal Rafter, as d, fram'd into the Top of a King Poſt, as c; and is generally framed as F, G.

At B, is the Joynt of a Strut or Brace, as f, fram'd into the Bottom of a King Poſt, as e; and may be framed as F, G: This is when Timber is ſcanty, or elſe the beſt Way is at C; let b, be the King Poſt, and a, the Strut or Brace, and framed as F, G.

In D, is ſhewn a different Manner, for Variety more than Uſe; and may be framed as H, I; becauſe then the Butment on the Side of the Tenon may be cut, as the prick'd Line h; tho' the Joynt next the Eye, be as appears at g.

In E, is ſhewn (tho' tedious) a true Way to make a proper Joggle on a King Poſt. Let a, b, repreſent the Top of a Beam, and c, d, the Bigneſs of a Brace, to be uſed; with c, d, form a Circle as h, g, f; from the Point d, ſet the Slope of the Brace, as d, e; alſo its Bigneſs, as from i, to d, and from k, to e; by PROPOSITION O, find the Point of Touch, i; ſo is i, l, the Side of the King Poſt.

Let K *, repreſent a Beam, and I *, a principal Rafter: It is to be framed as H, I; for then the Butments give it a greater Strength.

In F, and G, is ſhewn the Proportion a Tenon or Mortice ought to bear to the Stuff to be made uſe of, for the aforeſaid Uſes, or for Partitions.

In H, and I, the Proportion for the Tenon or Mortice for the Uſe obſerv'd above.

In K, and L, is ſhewn the Proportion the Tenons and Mortices of Floors ought to bear to the Thickneſs or Depth of the Stuff to be uſed; and here it may not be amiſs to obſerve, that I do not inſiſt it ought to be exactly ſo, but at the ſame Time, the nearer the better.

CONSIDERING Difficulties often ariſe, from Placing Timber different Ways, and the Framing Timber together for their ſeveral Uſes, therefore it is neceſſary to obſerve which Way the Timbers are to lie, and alſo how they ſhall be framed.

Therefore, here is the Plan of a Houſe; in which is ſhewn, by the prick'd Lines, the beſt Way of Placing your principal Timbers, ſo as to lie firm, and at the ſame Time to have the Boards lie all one Way, which is generally the Way that you have the beſt Viſtoe; as M*, N*, O*.

Becauſe I would not confuſe the Plan, by ſhewing the Manner in which the Floors are to be framed, therefore obſerve the Floors of three Rooms; as P*, Q*, R*.

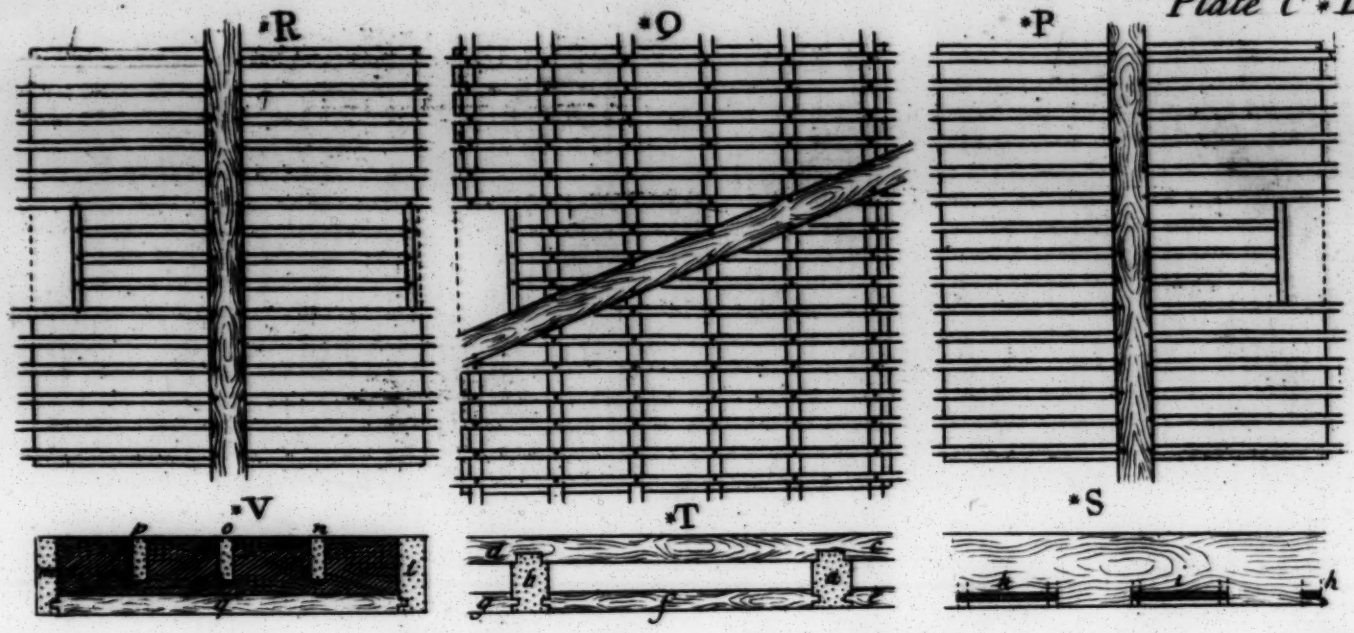
That of Q*, is call'd Bridging Floors, as being framed with a Binding, or ſtrong Joynt, in every three or four Feet Diſtance, and fluſh to the Bottom of the Girder; ſo that when the Houſe is cover'd in, you pin down your Bridgings thereon, and fluſh with the Top of your Girder: And this is the beſt Way of Carcaſe Flooring.

That of P*, and R*, may as well be framed fluſh to the Top of the Girders in each, and have every third or fourth Joiſt the Depth of the Girder, and thoſe between more ſhallow.

In T*, is ſhewn the Manner of Bridging Floors; a, and b, are the Ends of two binding Joiſts, on which is the Bridging, d, c; and into theſe Binding Joiſts, are fram'd the Cieling Joiſts, e, f, g.

In V*, is ſhewn two deep Joiſts of the other Floors, or common Way, as l, m; and alſo three ſhallow ones, as n, o, p; and alſo the Cieling Joiſt, q. And becauſe theſe deep Joiſts, as well as Bridging Joiſts, are ſo prepared as to be put in the Cieling Joiſts, when the Houſe is cover'd in, obſerve in S*, the ſuppoſed Side of either, with the Mortices for the ſaid Cieling Joiſts; as h, a ſingle Mortice, and i, k, double, or Pully Mortices, (as they are call'd.)

Plate C*D.



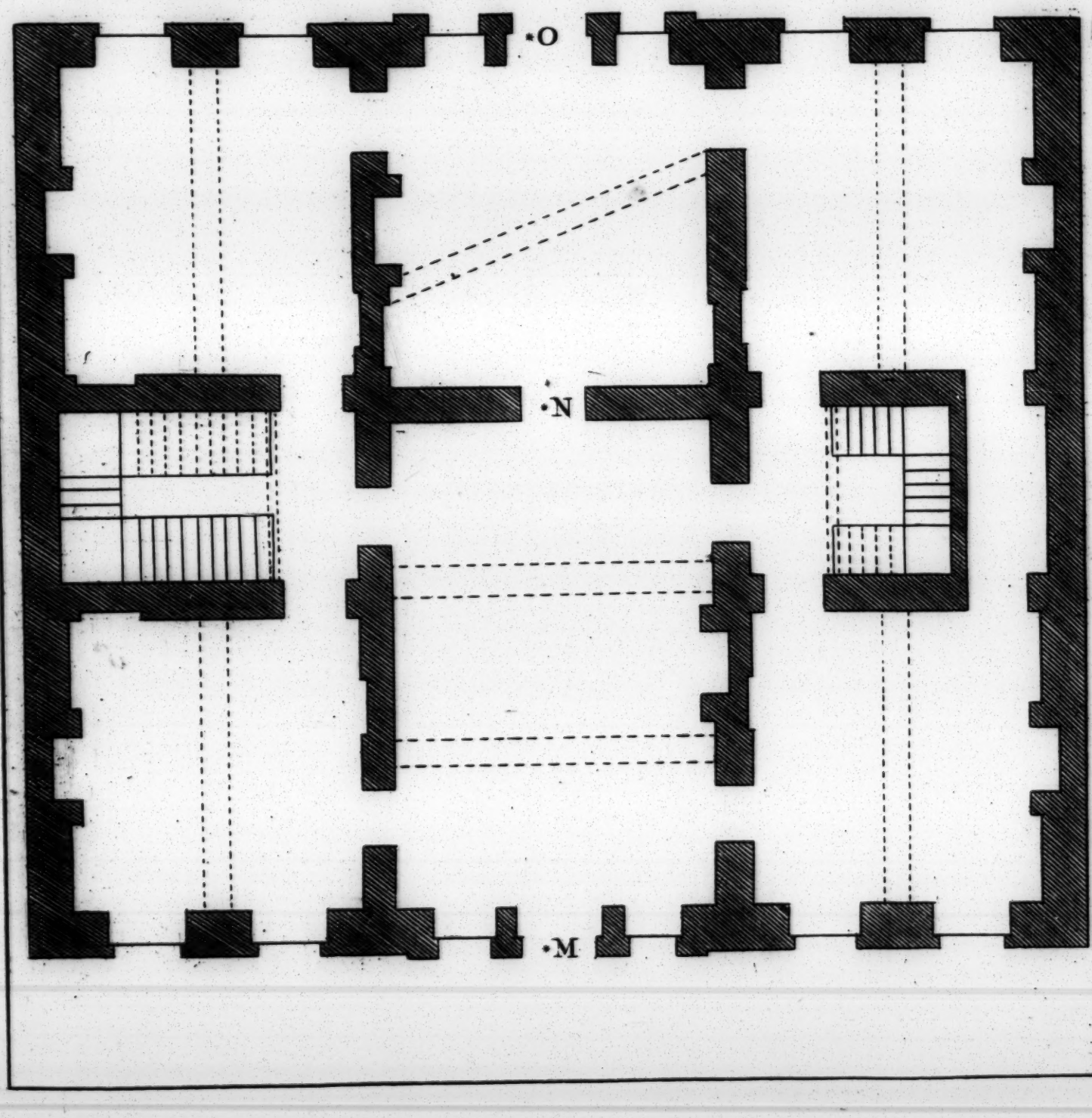
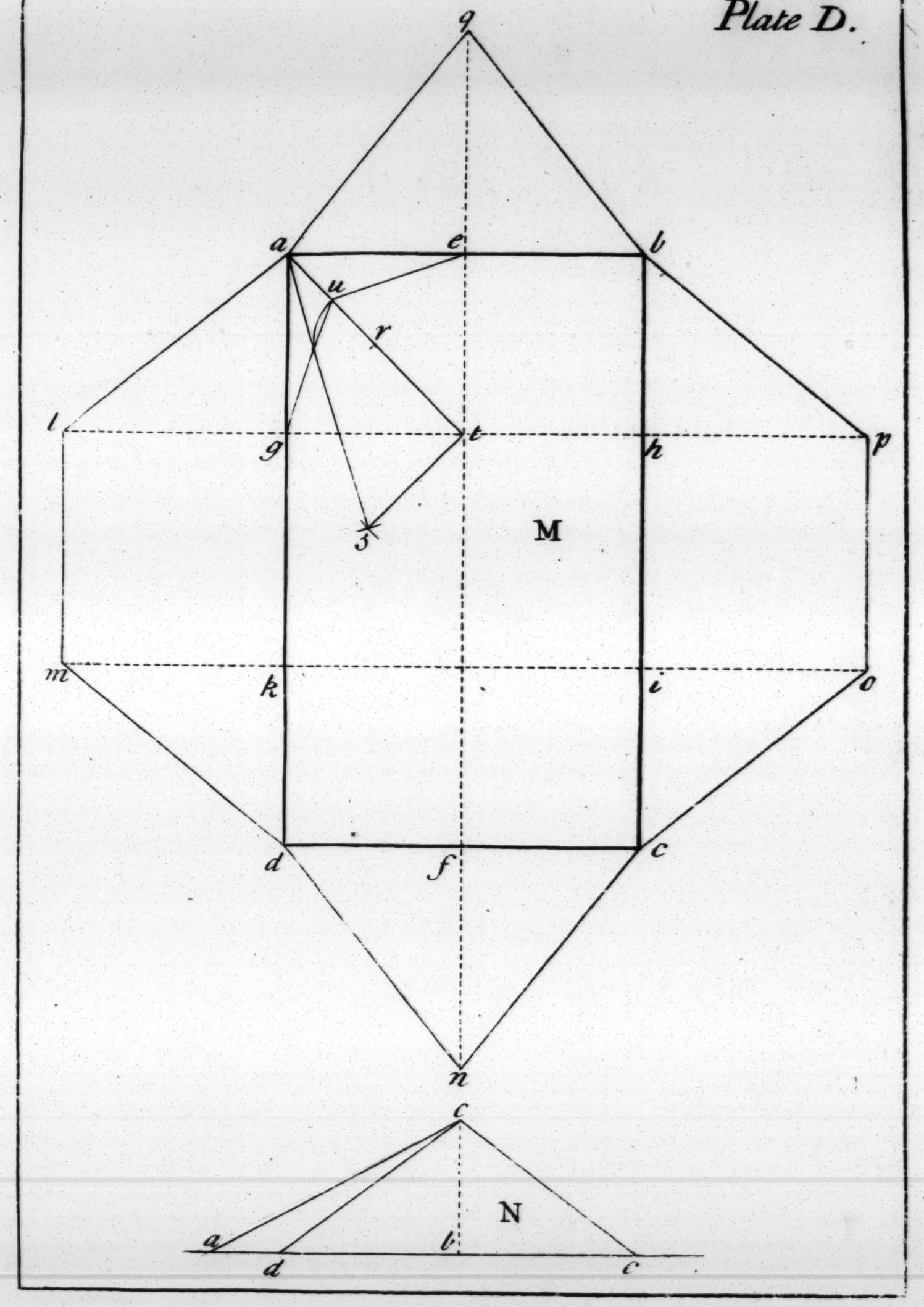


Plate D.



DIRECTLY after having ſhewn how Timber is to be framed together, it appear'd neceſſary to obſerve how Roofs are to be form'd, and in which I have uſed, what is ſaid to be Mr. *Pope*'s Method.

Let M, be a Plan to be incloſed with a Hipp'd Roof. To find its Skirts; firſt, form ſome Slope, or Pitch, as at N, *which ſhall be better clear'd in the following Plates.*

Let a, b, c, d, be the Plan, which divide in two equal Parts, as e, f; draw that Line at pleaſure, long enough; ſet the Diſtance of that Middle Line, as from a, b, to g, h, which alſo draw long enough, at pleaſure; again, ſet the ſame Diſtance off, as from c, d, to i, k, and draw that Line alſo at pleaſure; this done, apply to N, where d, c, or c, c, each alike are the Length of the Rafter, which ſet off, as from e, to q; and from h, to p; and from i, to o; and from f, to n; and from k, to m; and from g, to l.

Apply to N, take the Length of the Hip a, c; which is found by taking the Baſe of the Hip in M, as a, t; and is ſet off in N, as from a, to b; which Length is the ſame as was given by limiting the Length of your Rafter on each prick'd Line; ſo that, your Skirts is a, q, b; and b, p, o, c; and c, n, d; and d, m, l, a.

To find the Back of the Hip. On its Baſe a, t, in M, make the Angle a, t, s, in M, from a, b, c, in N; divide the Line a, t, in M, into two equal Parts, as at r; place one Foot of your Compaſſes in r, extend the other to the neareſt Diſtance, it will touch the Hip a, s; with that Diſtance make a Section; obſerve where it cuts the Baſe, as in u; g, u, e, is the Back of that Hip.

This is the Method given by Mr. *Pope*, as it's ſaid, for either Square or Bevel Roofs, either above Pitch or under.

EVERY Man may judge that Bevel Buildings ought to be avoided if poſſible; but as it frequently happens otherways, ſee the Plan O, whoſe Angles are unequal.

Let a, b, c, d, be the Plan. Firſt, take the Middle of it, as e, f; with that Diſtance, draw from r, to e, and ſquare to ſome Side; draw through the Line g, h; alſo with that Diſtance, placed from s, to f, and ſquare from one Side, as before, draw through, at pleaſure, the Line i, k. This being done, ſhew ſome Pitch, or Slope, as in P, at h, r, g, which is the Pitch, or Slope; h, r, or g, r, being the Length of the Rafter, terminate the ſame, as before.

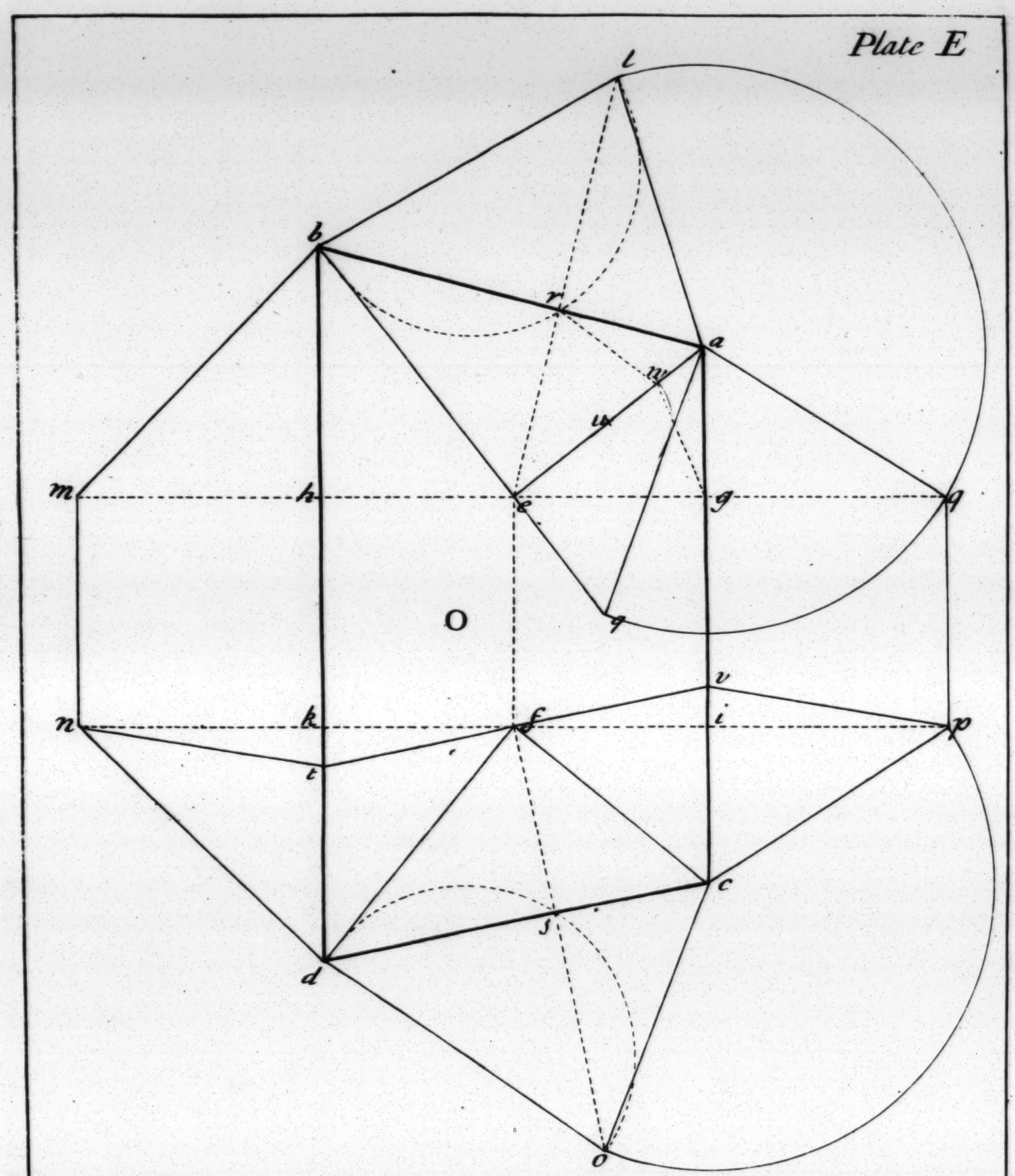
Draw the Baſe of each Hip in the Plan O; as e, a, and e, b; alſo f, c, and f, d; which, being applyed to the Section P, ſhew the Length of each Hip: So that by this, or the foregoing Plate, deſcribe the Skirts a, l, b; and b, m, n, d; and d, o, c; and c, p, q, a. By Propoſition B, draw the Line l, r, e, being the Rafter and Beam, each being ſquare; as alſo that of o, s, f.

Thus by laying your Beams ſquare, you have little Trouble more, than if your Building was ſquare; otherways than having the Trouble to back each Hip ſeparately; altho' here is only one ſhewn, the Rule being ſaid to be general.

The Lines n, t, and t, f, u, and u, p, are only to ſhew the Trouble that attends laying the Beams Bevel; the large Circles are only to ſhew the Hips equal in Length, one to its oppoſite.

To back the Hips, obſerve in the Plan O, a, e, q, is the Hip taken from P; divide the Baſe of the Hip, a, e, into two equal Parts, as before; place one Foot of the Compaſſes in u, extend the other Foot to the neareſt Diſtance, it touches the Hip a, q, which ſet on the Baſe, as at w; r, w, g, is the Back of that Hip; and ſo of the reſt, reſpectively, by the ſame Rule.

Plate E



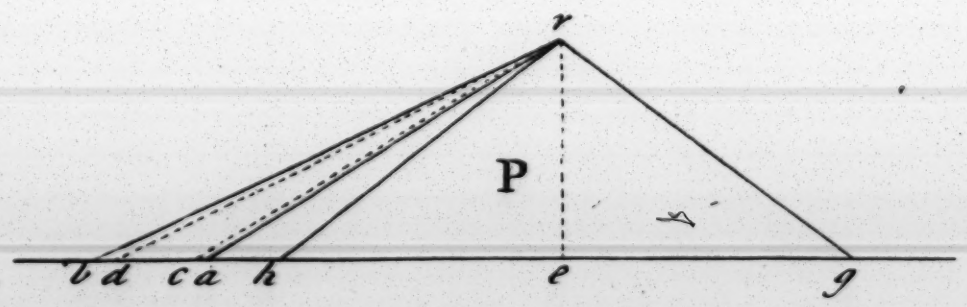
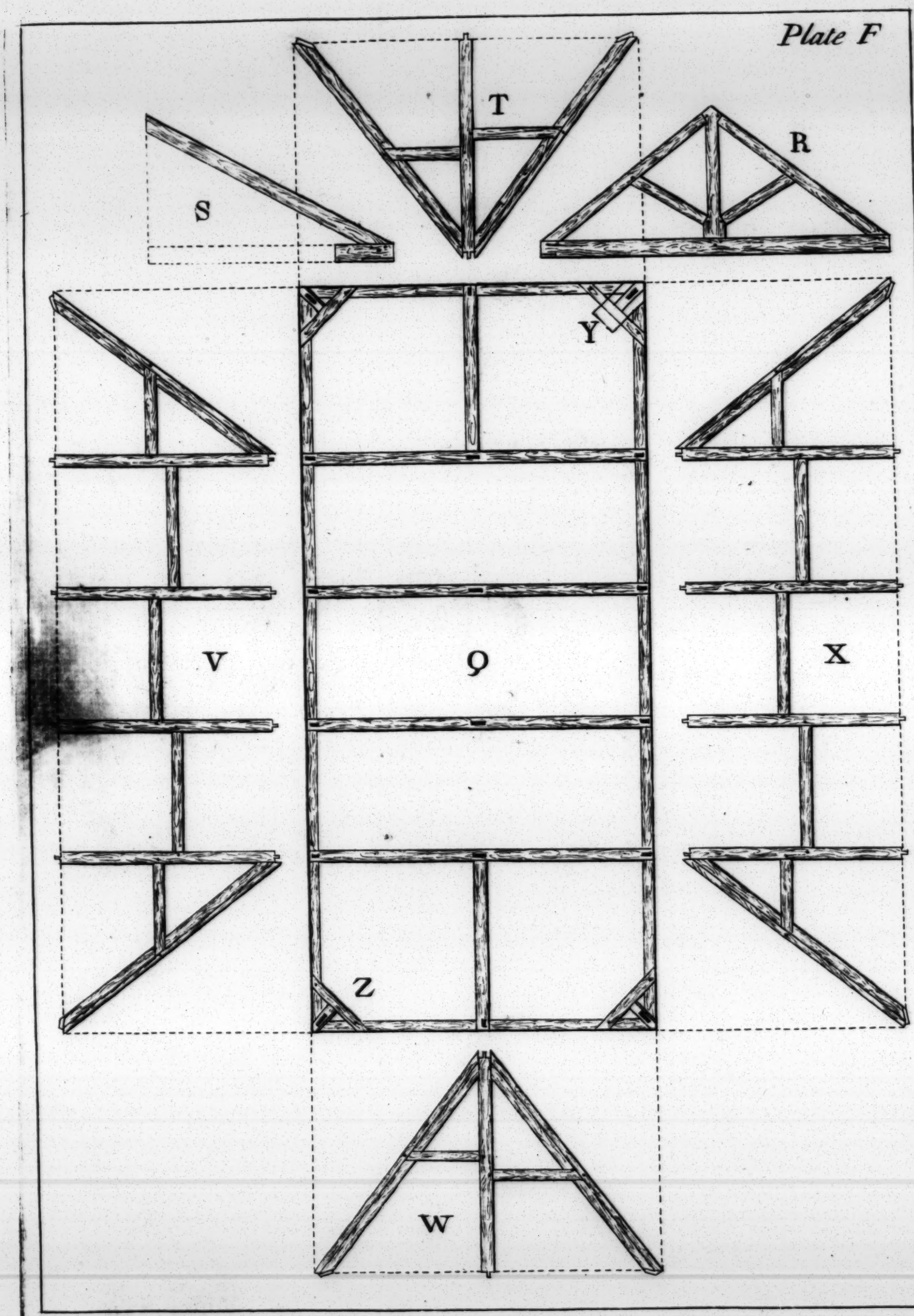


Plate F



FOR better Inſtruction to ſuch as love Variety, here is repreſented a Floor, and Roof, lying in Ledgement.

Every Man who frames Roofs, does firſt piece his Plates, cock down his Beams, and prepare Pieces on which his Hips are to ſtand, as appears in this Plan Q; as at Y, Z.

Then he frames his Principals, as R; and likewiſe his Hips, S, into the Pieces prepared for them to ſtand on: And altho' all theſe reſpectively are framed, for the generality, on the Floor, they are here kept by themſelves, to avoid Confuſion.

I hope the prick'd Lines are enough to ſhew the Skirts, laid out agreeable to the Plan Q, as T, V, W, X; and in which are ſhewn that the Purlins ought to miſs each other: For beſides that one Purlin lyes above the Strut, and the other below it, if all were to lie in a right Line, in the firſt Place, it cuts the Stuff to Pieces, ſo as to weaken it ſtill more, and at the ſame Time, you looſe your Pinning.

If the Backing of the Hip be, falſe (as ſometimes I have heard it affirm'd to be,) here is ſhewn a Method to turn up your Hip without Backing at all; and is thus: Your Hips being firſt framed into the Pieces they are to ſtand on, take a broad Board, or ſmall Pannel; lay it on the Place where your reſpective Hip ſtands, and there mortiſe it as if it was your Beam; cut off the Corners of it, ſo as to make its Angles agreeable to your Plan, whether ſquare or bevel; laſtly, when you come to turn up your Hip in framing the Skirts, ſlip this Mould, as Y, upon the Tenon at the Foot of your Hip, and there give it a Tack with a Nail; the Angles of that Board will turn up a Hip, as deſired.

FOR Granted I take it, that I did make myſelf intelligible in PLATE E: My Meaning there being to ſhew how to avoid Abundance of Trouble if poſſible: But becauſe ſometimes Buildings muſt be Bevel, and Neceſſity requires the Beams to be laid ſo, to miſs ſome Chimney or Window; therefore let A*, repreſent a Bevel Plan, and whoſe Beams alſo lie Bevel; I doubt not but the prick'd Lines will ſhew from the Plan A*, to the Skirt B*, how much each principal Rafter muſt lie bevel, and that, juſt as much as Half the Beam does lie, that the Rafter ſtands on; the Skirts C*, D*, E*, are the ſame Way ſhewn.

The Method before deſcribed in PLATE F, with being ſeparately applied, will turn up each Hip, and alſo each principal Rafter.

I hope it will not be taken ill, my ſaying that a Man muſt be deprived of Senſe, who would run into this almoſt endleſs Trouble, unleſs ſome unavoidable Neceſſity require it, ſuch as above is obſerv'd, but rather uſe the Method, I propoſed in Plate E.

The Side of each principal Rafter, and the prick'd Line, is the exact Bevel of each, as by the Skirts lying in Ledgement may appear, if compared to the Bevel of the Plan.

In this, and all other ſuch Difficulties that muſt be well underſtood before executed, I adviſe that a Model be cut out of a Piece of Wood, by a large Scale; or with ſlit Deal, cut out the Skirts as has been ſhewn, and by putting them together, all Difficulties of this Nature may be ſolv'd: And which indeed is the plaineſt Way of Demonſtration.

Plate F.G.

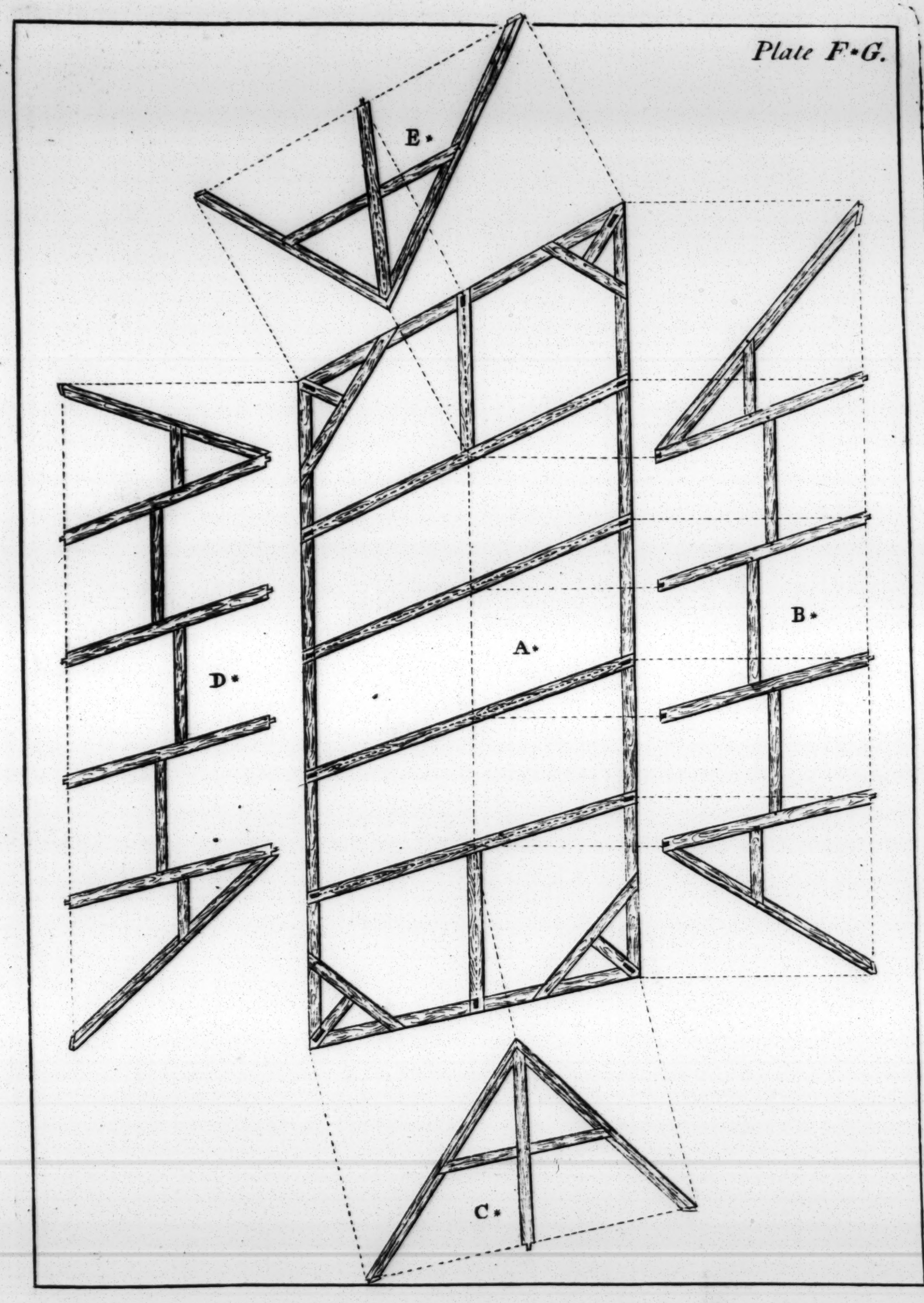
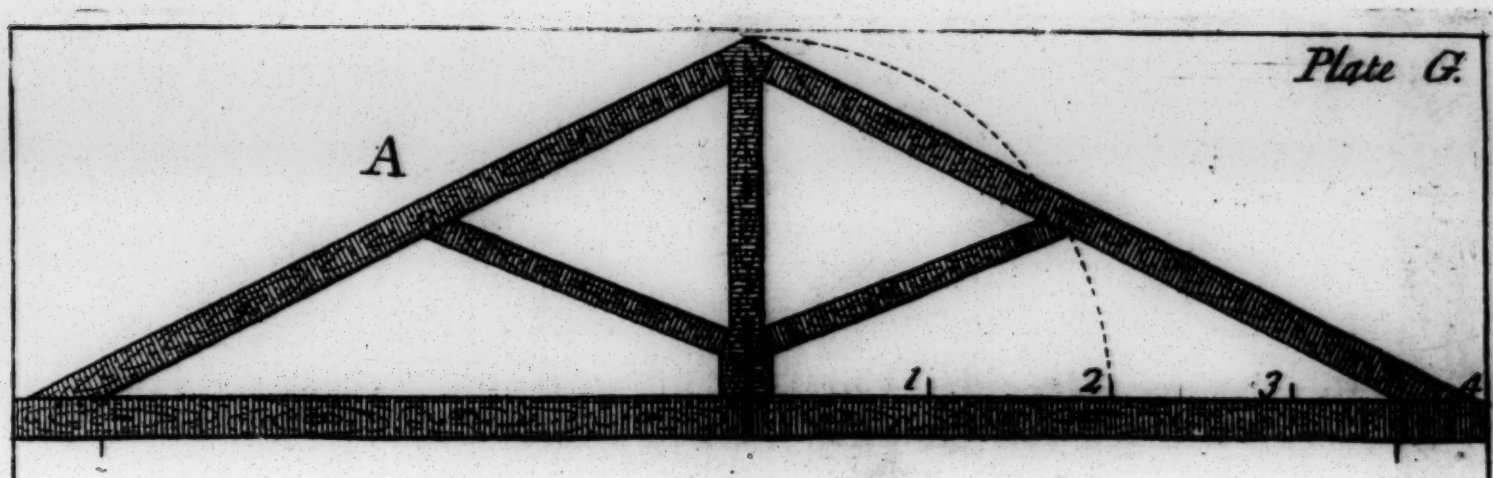
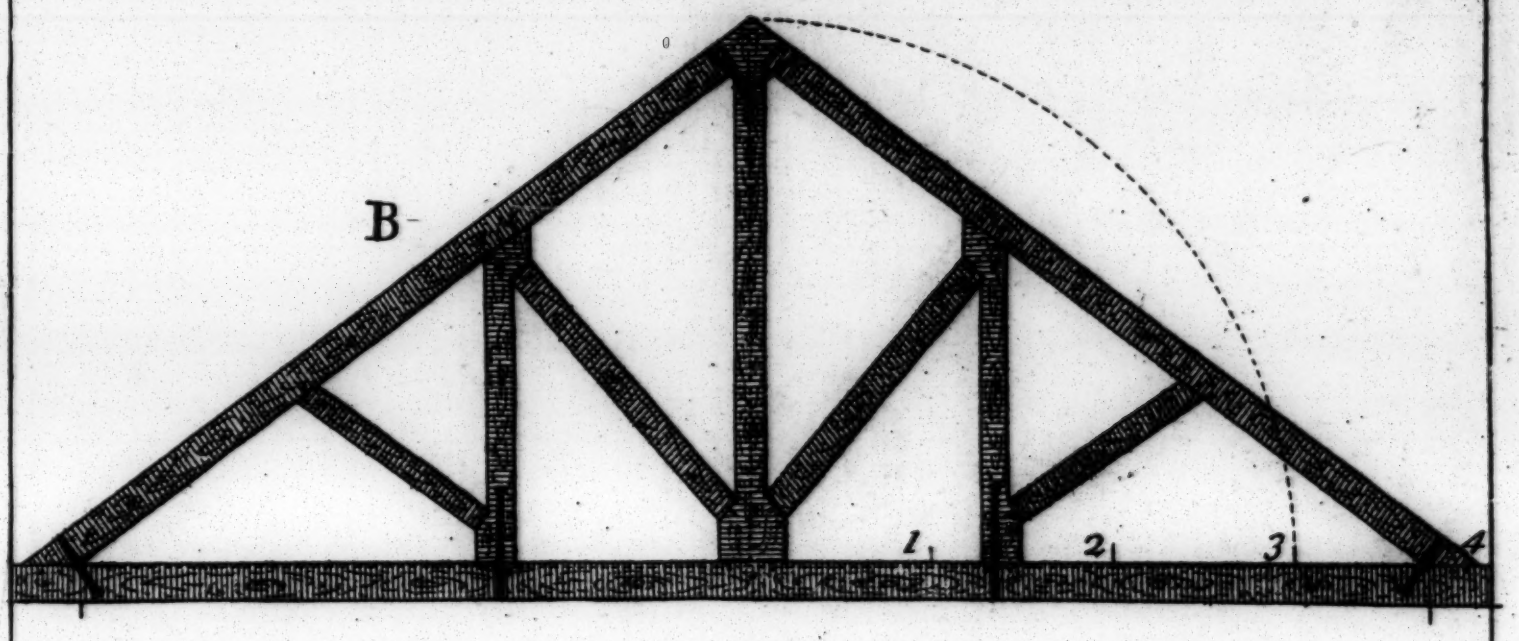


Plate G.

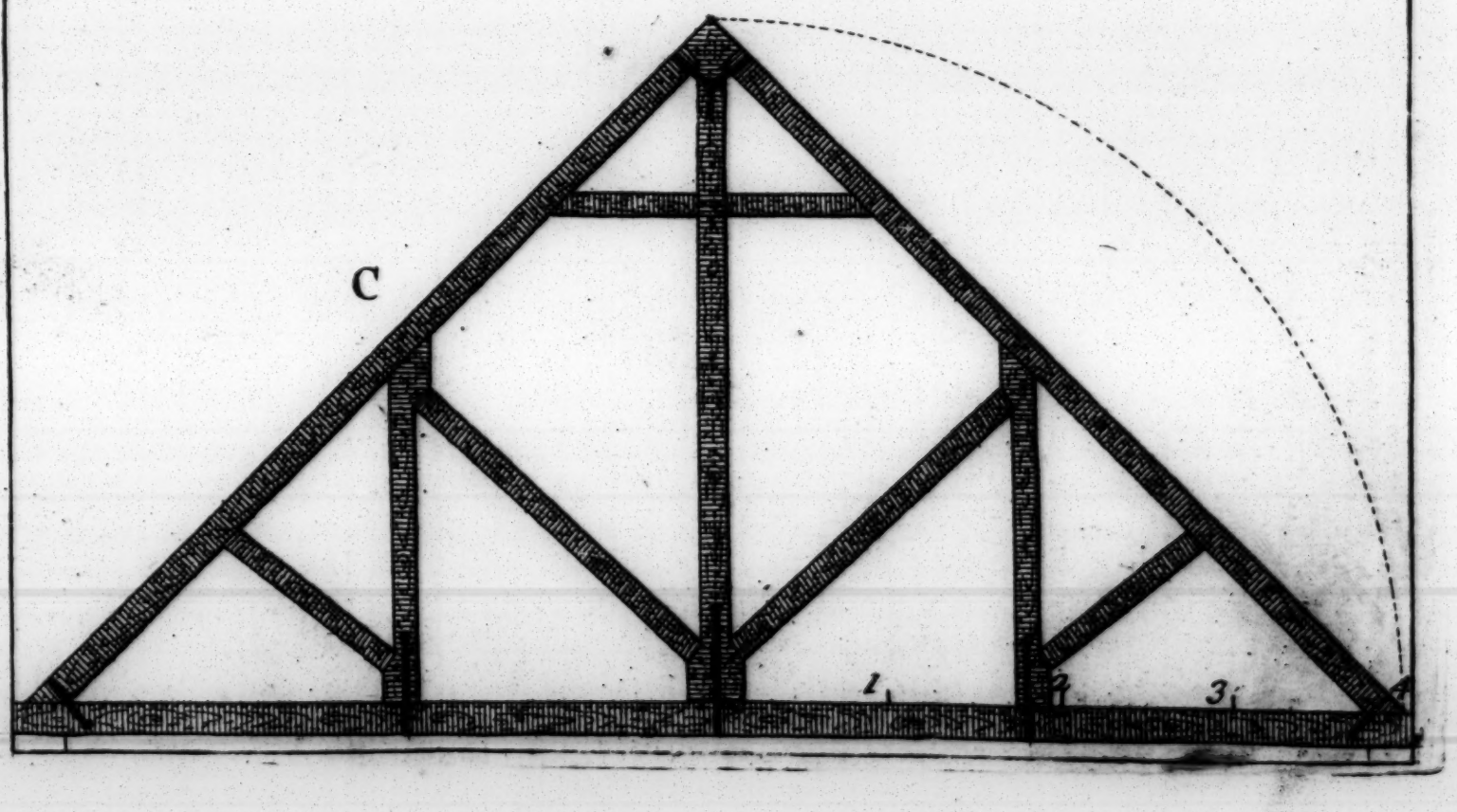
A



B



C



GRANTING that I have explain'd the Manner of laying of Roofs in Ledgement, as far as may be ſhewn by mere Inſpection, therefore, now I propoſe to ſhew the Manner of making different Pitches or Slopes, agreeable to each Kind of Covering in Uſe, as Lead, Pantiles, and Plaintiles.

Take any Width, as in A, and to be covered with Lead; divide the Width, firſt into two Parts; and one of them, again, into four, as 1, 2, 3, 4; at 2, and with two of theſe Parts, deſcribe the Quarter-Circle, as by the prick'd Line appears; ſo is it a proper Pitch, or Slope to be cover'd with Lead: And is call'd Pedement Pitch.

Again, take any Width, as in B, and to be covered with Pantiles; divide it, as before, into two Parts, and again one of them into four, as 1, 2, 3, 4; with three Parts, as at 3, deſcribe the Quarter-Circle, which appears by the prick'd Line: Which is a proper Pitch for the Uſe.

Alſo take any Width, as in C, and to be covered with Plaintiles; divide it into two Parts; with one make the Quarter-Circle, as the prick'd Line ſhews: Which gives a Pitch, or Slope proper for the Uſe.

As to each Half being divided into 1, 2, 3, 4, I hope 'twill not offend any, ſince two out of the three are Methodical.

The Truſſes in each have been practiſed with Succeſs; and therefore better to begin with.

The ſhort Lines under each Beam, is ſuppoſed the In-Side of the Wall.

HOW neceſſary theſe Roofs may be thought, I cannot ſay; but they were introduced, leſt the Methods made uſe of before, ſhould not give Variety enough. And altho' it ſhould be argued, there is not a Neceſſity for either, yet the Truſſes in each, may be acceptable: And I think they need no Apology.

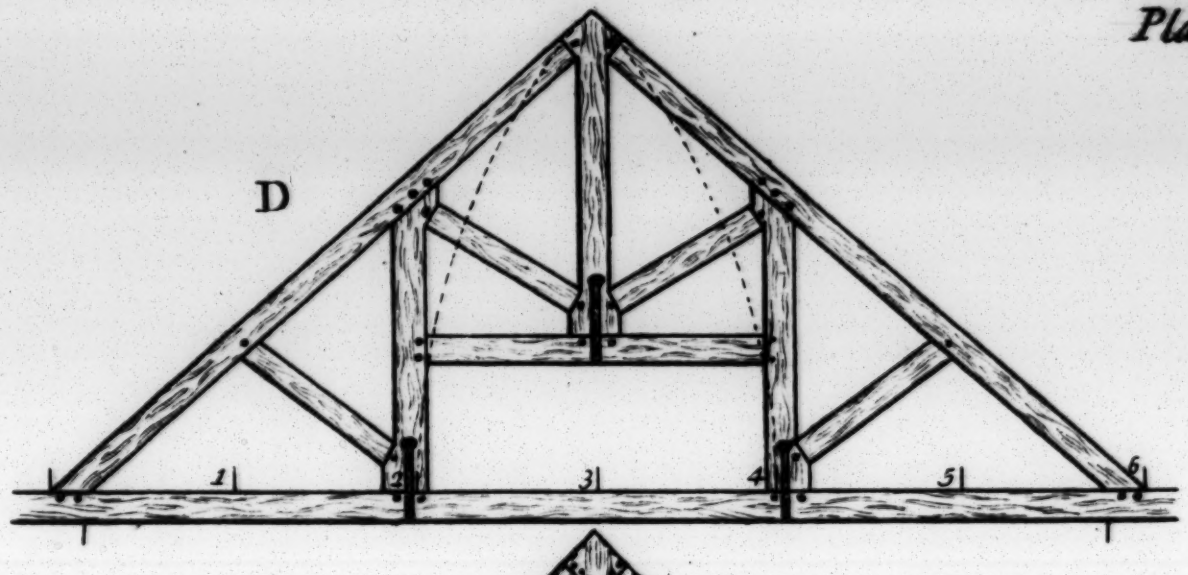
Take any Width, as D, which is to be covered with Pantiles; divide it into ſix Parts, as appears by the Draught; take four of theſe Parts, and with them make two Sections, as the prick'd Lines ſhew; the Interſection of theſe Lines gives the Height, or Pitch of the Roof.

Take alſo any Width, as E, which is to be covered with Slates; divide it into ſeven Parts; take five of them, make the two Sections; their Meeting forms a complete Pitch, or Slope for Slates, as appears by the Draught.

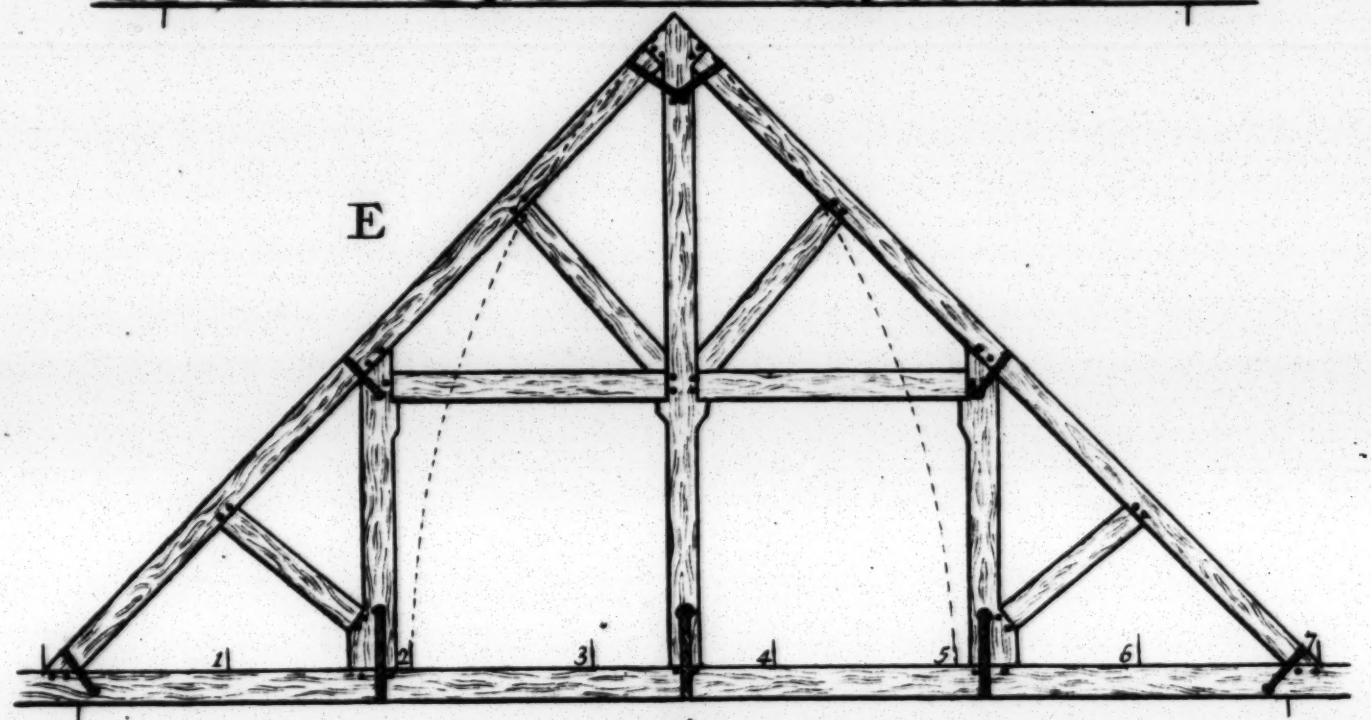
Take any Width, as in F, and to be covered with Plaintiles; divide it into eight equal Parts; with ſix of thoſe Parts, make the two Sections; their Meeting forms a Slope proper for Plaintiles, called true Pitch.

Plate H.

D



E



F

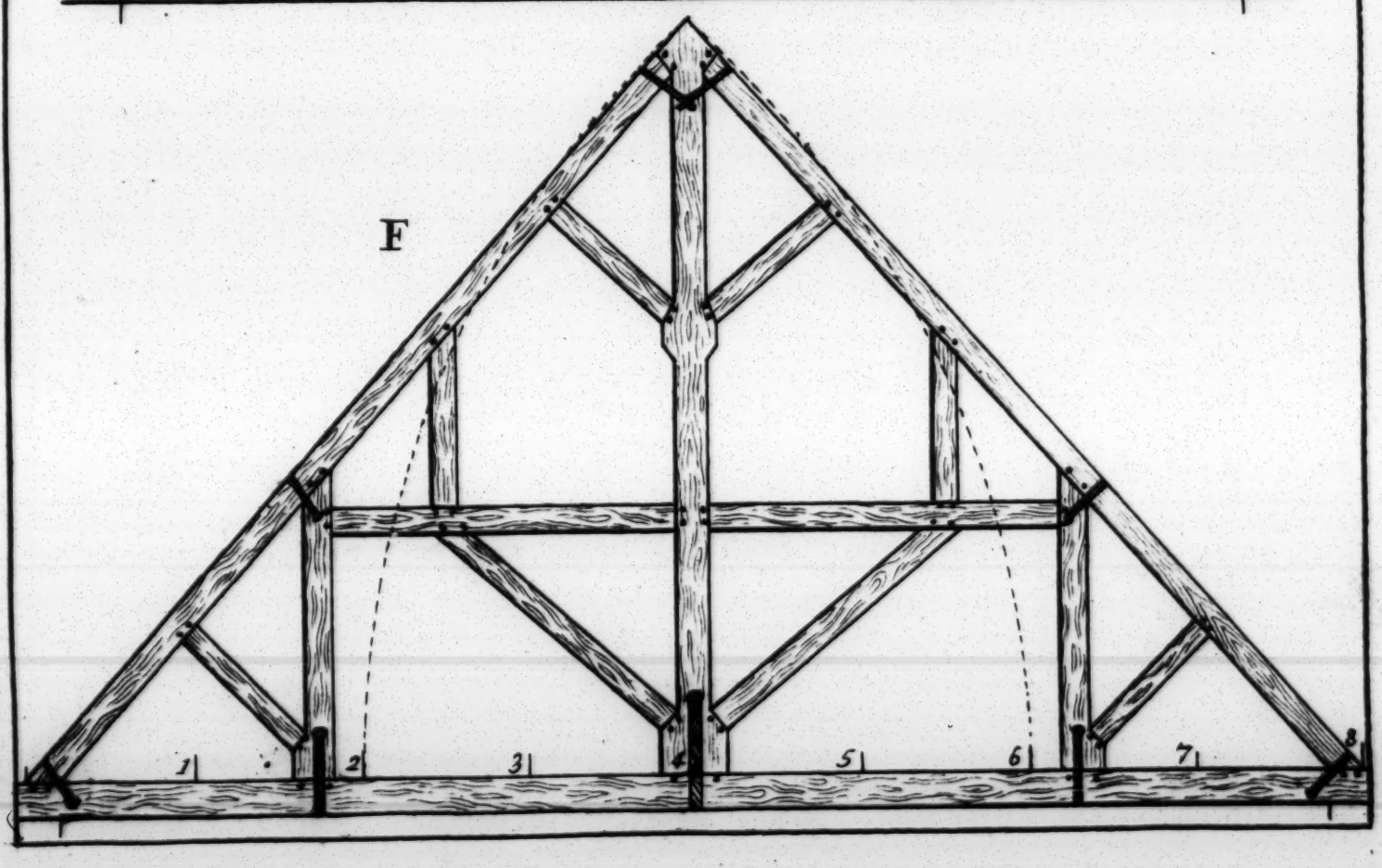
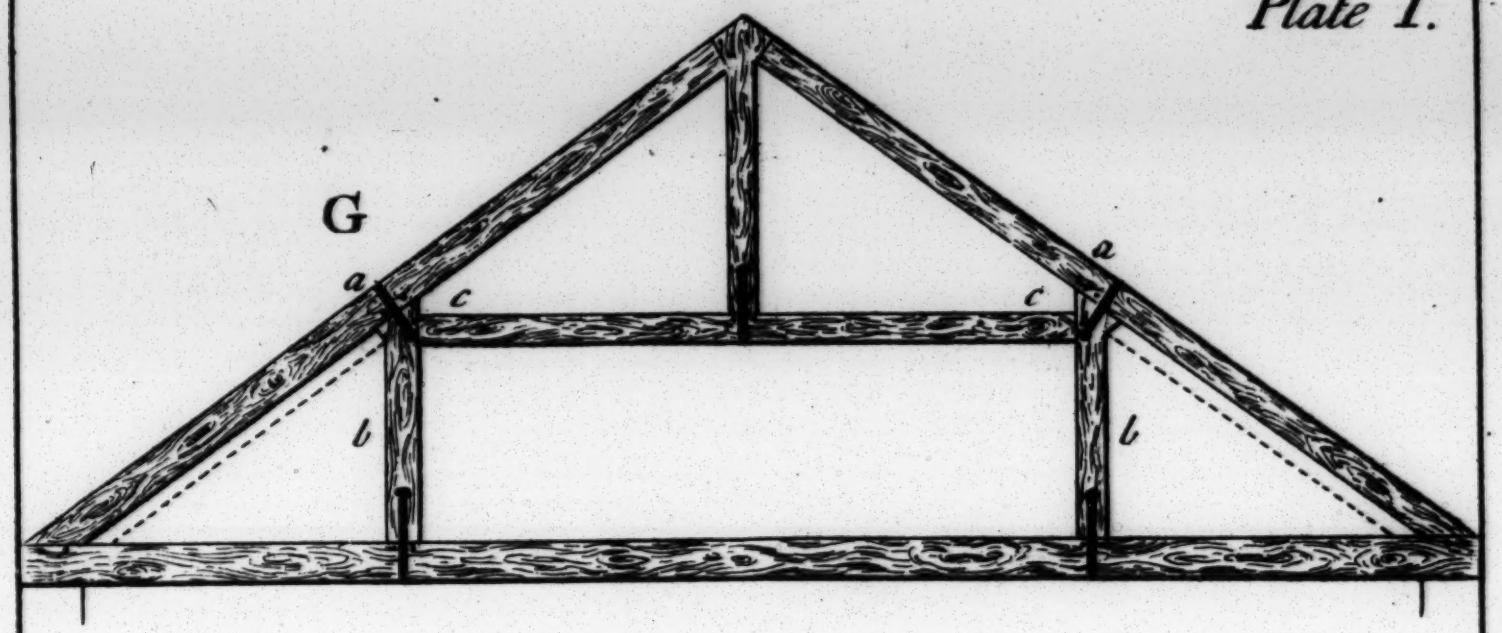
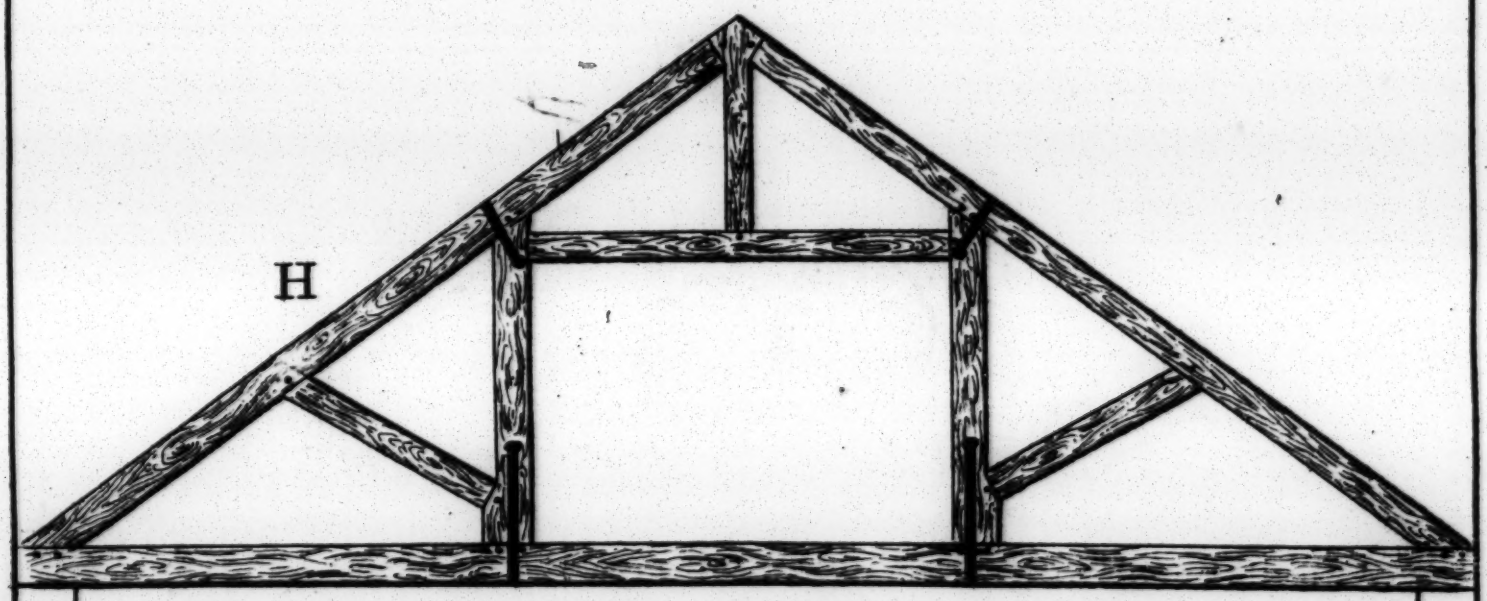


Plate I.

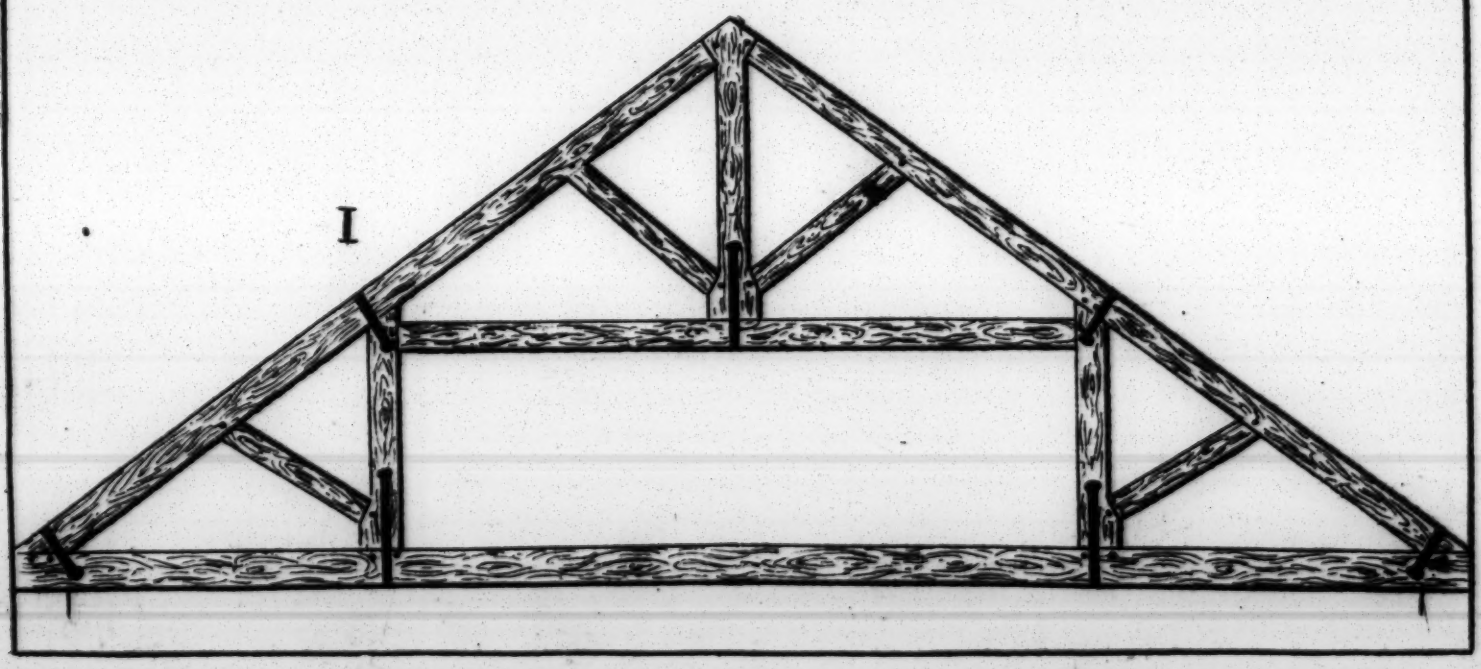
G



H



I



I BELIEVE theſe Truſſes may be acceptable, although they differ ſo very little from thoſe in the laſt, PLATE H.

In G, the prick'd Poſts b, b, (or King-Poſts b, b,) being tyed to the Back of the Rafter, as at a, a, with iron Straps, as appears in the Draught, ſo firm that it cannot yield; if the Strutting-Beam c, c, be drove in very tight, it takes all the Weight off from the Rafters, as at a, a, and if ſome extraordinary Weight be to hang thereon, as the Machinery of a Theater, then it would be well to cut the ſaid King-Poſts with a Joggle, by which means you might put Braces, as repreſented by prick'd Lines, under each Rafter, ſo as to make this Truſs able to carry any Burthen whatever, at the Extent of ſixty Feet, *&c.* allowing the Truſs G, to be ſufficiently ſtrong: I ſay, this of H, may be well adapted to many Uſes; as dividing the Floor, and Rafter each into three equal Bearings: If Occaſion require it, you may cut the King-Poſts with a Joggle, and make uſe of Braces as before.

Alſo this of I, by what was before ſaid, may be rendered a complete good Truſs for almoſt any Uſe, there being ſo large an Opening, as indeed is requiſite in what was before obſerv'd, altho' this allows of good Garretts, if uſed in a Dwelling-Houſe.

What is ſhewn, and mentioned in theſe three PLATES, of Roofs whoſe Ties remain entire, may be ſufficient.

All that I conceive neceſſary to be ſaid further, is, that the leſs the Diviſions, or Pieces are which compoſe each Truſs, the ſtronger it is; for even the Shrinking of the Wood will let a well-framed Truſs ſag, or droop, in Proceſs of Time; for which Uſe I cannot help recommending *Engliſh* Oak, particularly for King-Poſts,

KNOWING Variety to be moſt Entertaining, I have introduced four Truſſes, whoſe Tie or Beam is interrupted, and may be ſuited to ſome Places, where the others might not be ſo well adapted.

Here, in *Fig.* K, it is propoſed to demonſtrate the Strength of a Truſs, in ſuch a Manner, as to make it evident they are really ſtrong; and though this ſhould ſeem Tautology to ſome of my Readers, it will not, I am perſuaded, appear ſo to all.

Firſt, then, the Beam b, b, being tyed to the Back of each Rafter, as at a, a, with an Iron Strap, in a firm Manner; alſo the King-Poſt c, be tyed to the Beam b, b, I doubt not but the upper Part will be allowed ſtrong, or firm; if ſo, let the Hammer-Beams d, d, be well bolted to the Beam b, b, and the Bottom be framed as other principal Rafters generally are, as at e, e; I ſay, if it be objected that there is too much Truſt repoſed on the Iron-Work, may it not be asked, if any common Strap, at the Bottom of a King-Poſt, was ever known to break by continual Preſſure; and which perchance has been as much, or more loaded, than either of theſe may appear to be in reality? Witneſs the Straps in a Theater, to which is fix'd a prodigious Weight.

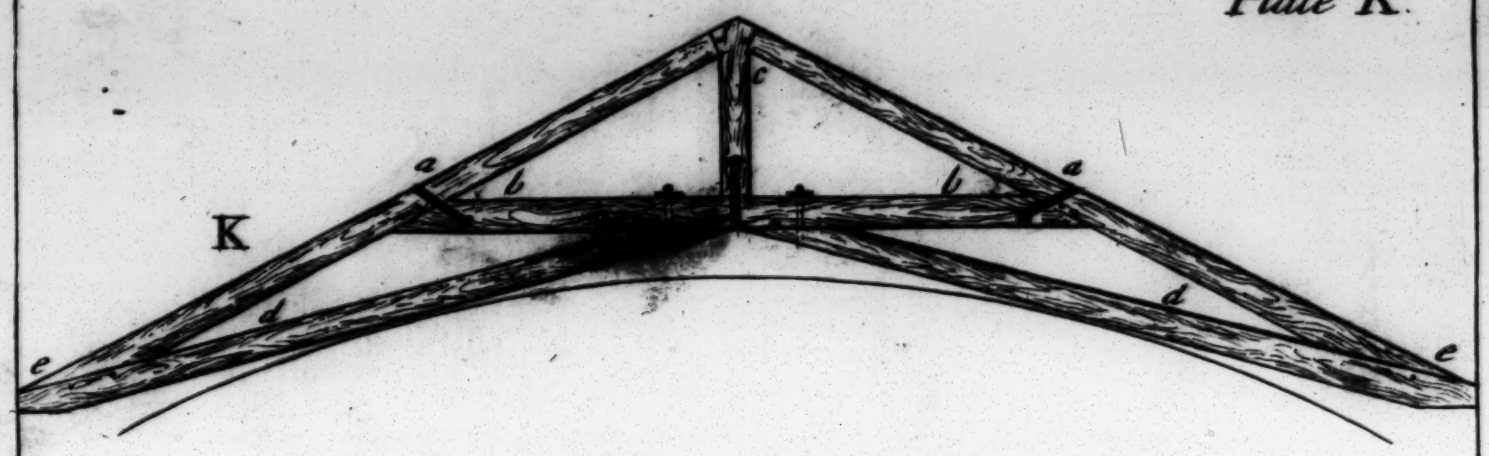
If that be granted, another Objection may ariſe; which appears in putting them together, and which I ſhall endeavour to anſwer.

Let the Truſs L, be required to be put together. Firſt, enter your King-Poſt into the Beam; put in your Braces; then enter the Top of your principal Rafters into the King-Poſt, as at f; ſo by bringing down its Bottom, you enter the Brace g, and Beam h; then enter your Hammer-Beam as at i; pin all together, and put on your Straps, and your Bolts through both Beams in a good Manner. Then let one think what Force can part them.

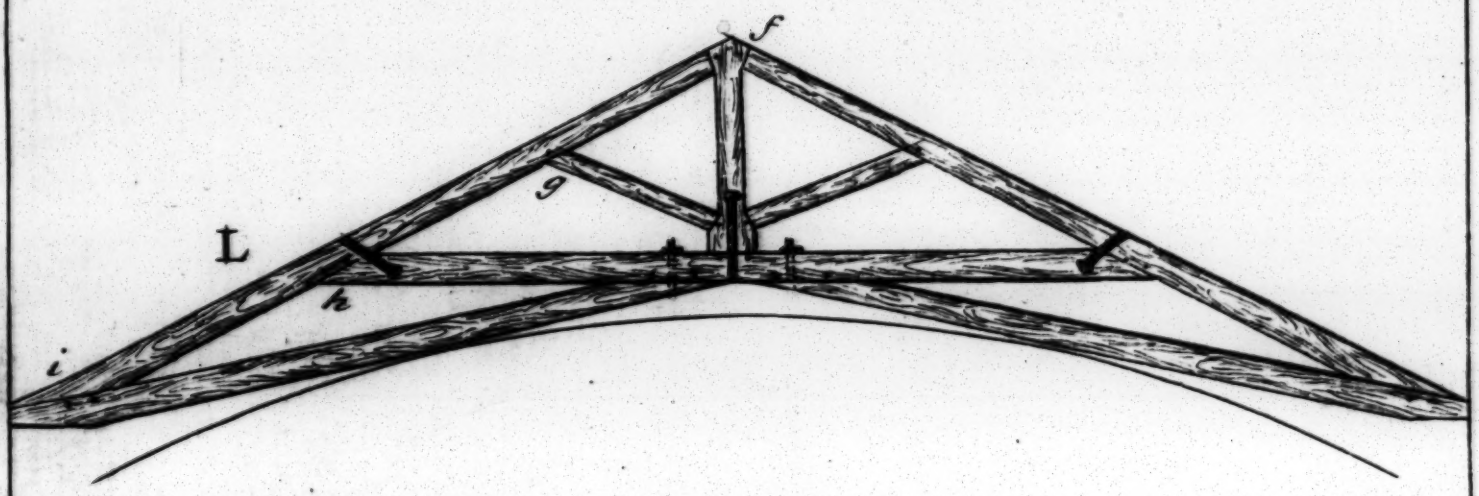
What is ſaid of this, may be ſaid of M, and N: Not that I would propoſe that theſe ſhould be uſed, without mature Advice.

Plate K.

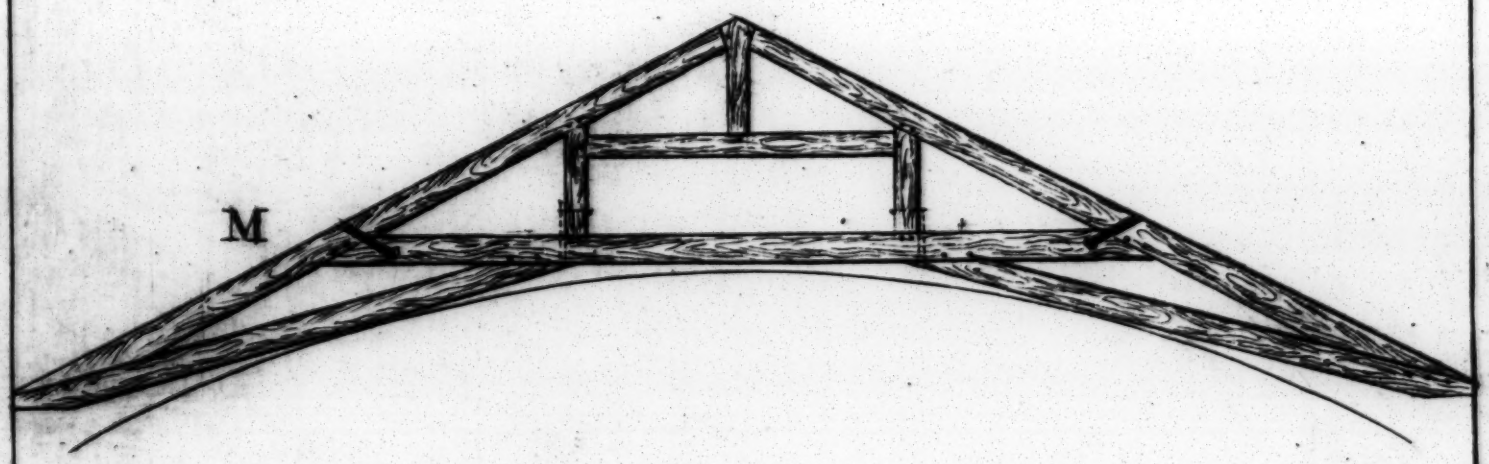
K



L



M



N

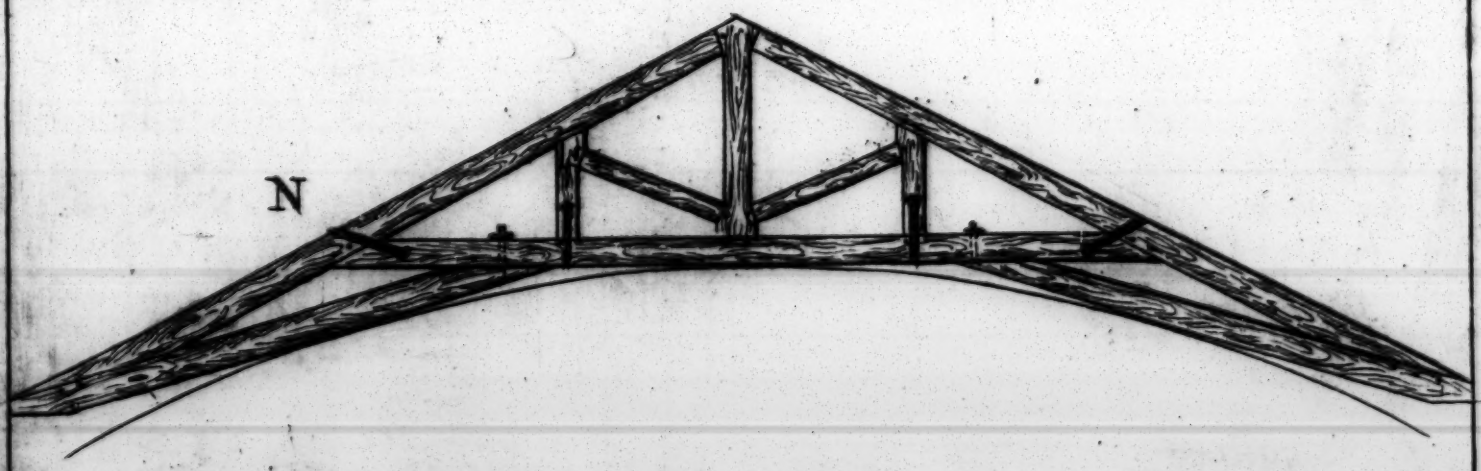
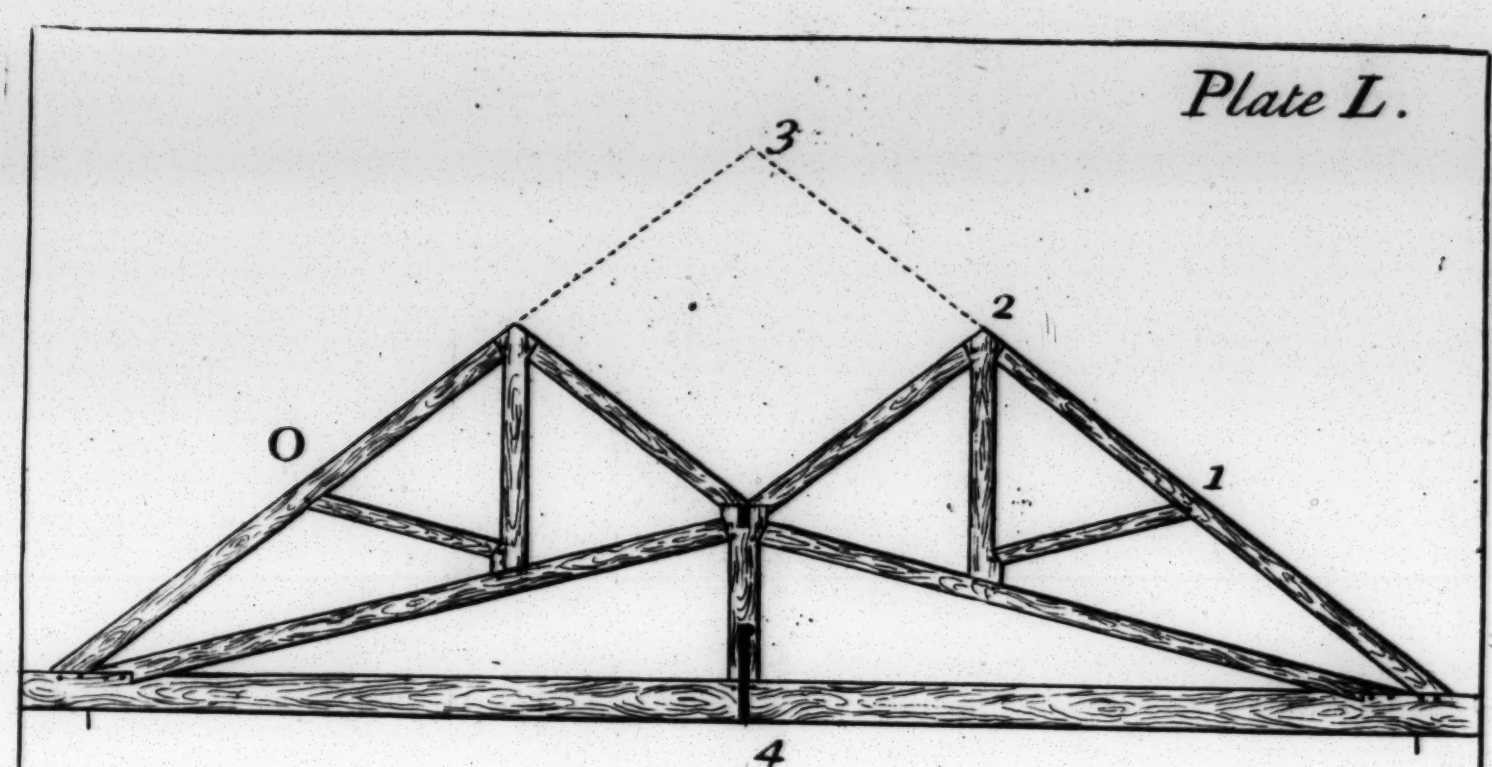
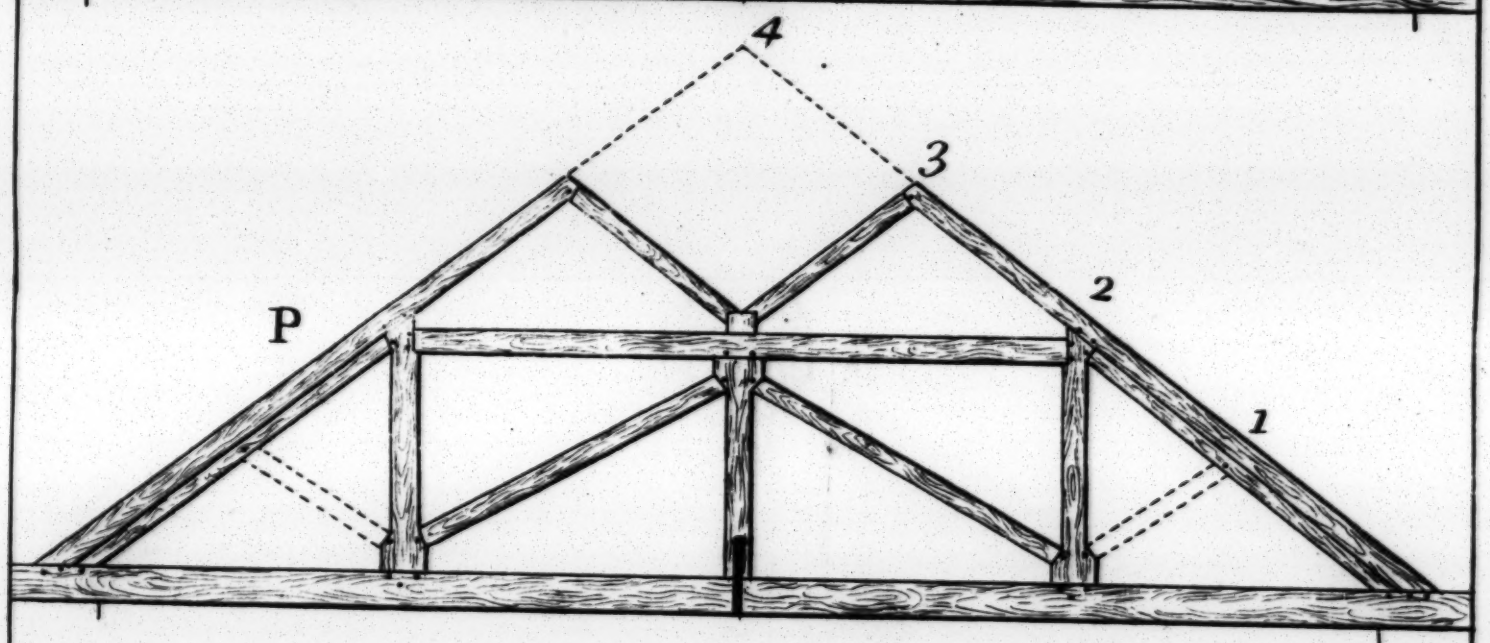
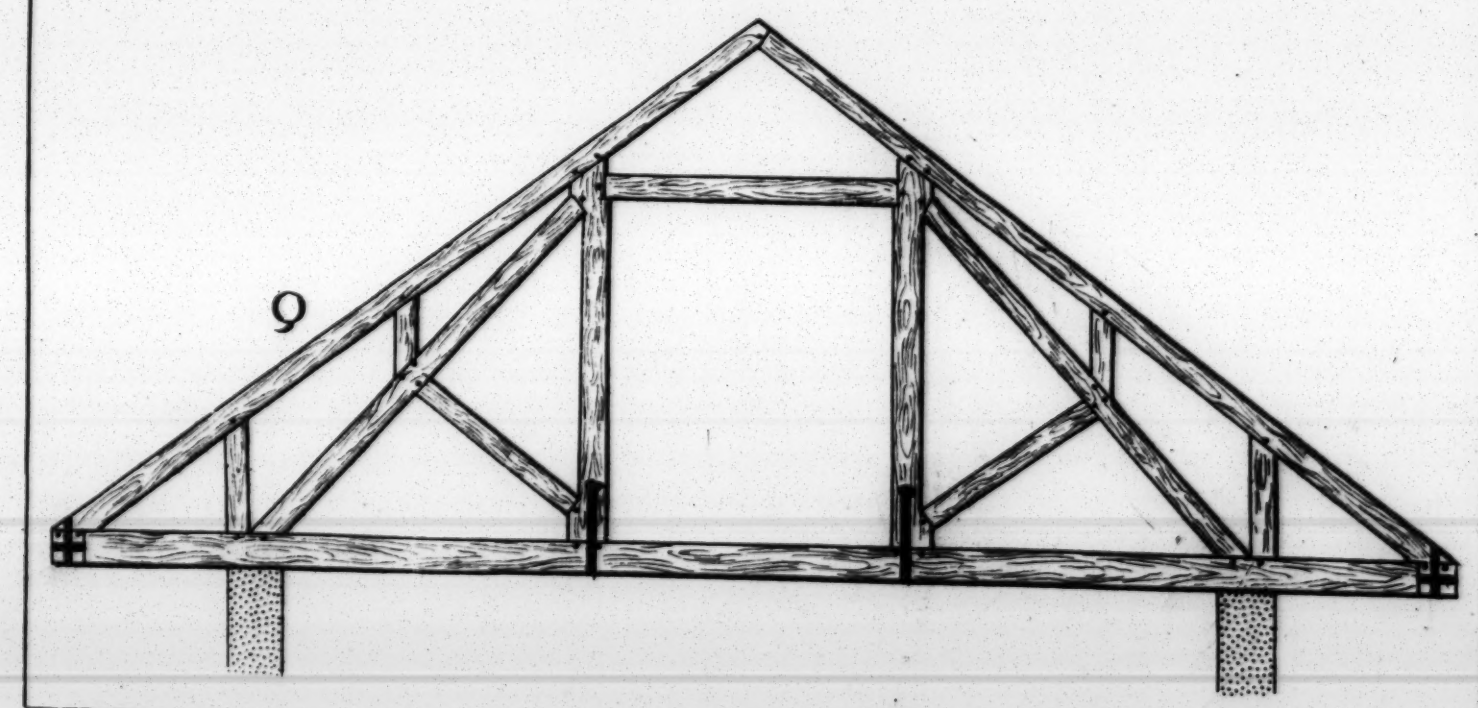


Plate L.







LEST it ſhould be thought a Neglect, I have ſhewn in two Examples, how to contract the Height of Roofs, which are call'd M Roofs, and frequently made uſe of.

Let O, be a Truſs for a Roof. By the Figures it appears that one third Part of its Height is taken off, and yet the Truſs is made firm with very little Stuff and Labour. On the Head of the Middle King-Poſt is let in a Gutter-Plate, which bears the Inſide-Rafters, and is ſo adapted to Uſe, that you may ſupport it at pleaſure, between one Truſs and the other.

In P, is ſhewn another Truſs for M Roofs; and by Inſpection may appear to be but three fourths of its Height, if the Rafters were continued. In this, the Gutter-Plate lies on the Strutting-Beam, and over the Head of the King-Poſt; by having thoſe Braces under the principal Rafters, I cannot ſay you need the Braces ſhewn by the prick'd Lines.

In Q, is ſhewn a Roof whoſe Span is beyond the Walls; ſuch as *Covent-Garden*, and *Horſley-Down* Churches, and which give a Kind of Shelter, therefore may not be miſapplied to other Uſes.

At the Foot of each Rafter is ſuppoſed an Iron Strap, that not only faſtens the Rafter and Beam together, but at the ſame Time paſſes through a Binding-Beam, whoſe Office is to bear the ſmall Rafters between one Truſs and the other; under which, and a-croſs the Main Beam of the Truſs, ſuppoſe a flat Bar of Iron, ſo that the End of the Strap has a Screw made on it; then conſequently two Iron Nuts at the Bottom make each Truſs exceedingly firm. I imagine there is no Difficulty in the Execution.

I do not mean to give offence, by deſcribing this Truſs different to either of thoſe mentioned, each doing its Office excellently well.

MANY Perhaps may be offended, to ſee that I ſhould deſcribe Roofs ſuited to Churches, ſeeing that ſo many have been done of late Years.

However, as I had theſe by me, and different in ſome Reſpects from what has been done, I hope they will be acceptable to ſome of my Readers.

In that of R, each Opening is an Ellipſis or Oval, which has been approved on, by competent Judges of the Art, to be beſt adapted to ſuch Uſes; and for its Strength, there ſeems to want little or no Apology.

In that of S, each Opening is an exact Semi-Circle, as it may beſt fall out to ſuit the Windows; and, to my thinking, has not ſo great a Bearing on the Columns that ſupport it, as ſome have had. Theſe may be adapted well to ſpan ſeventy or eighty Foot without any Difficulty.

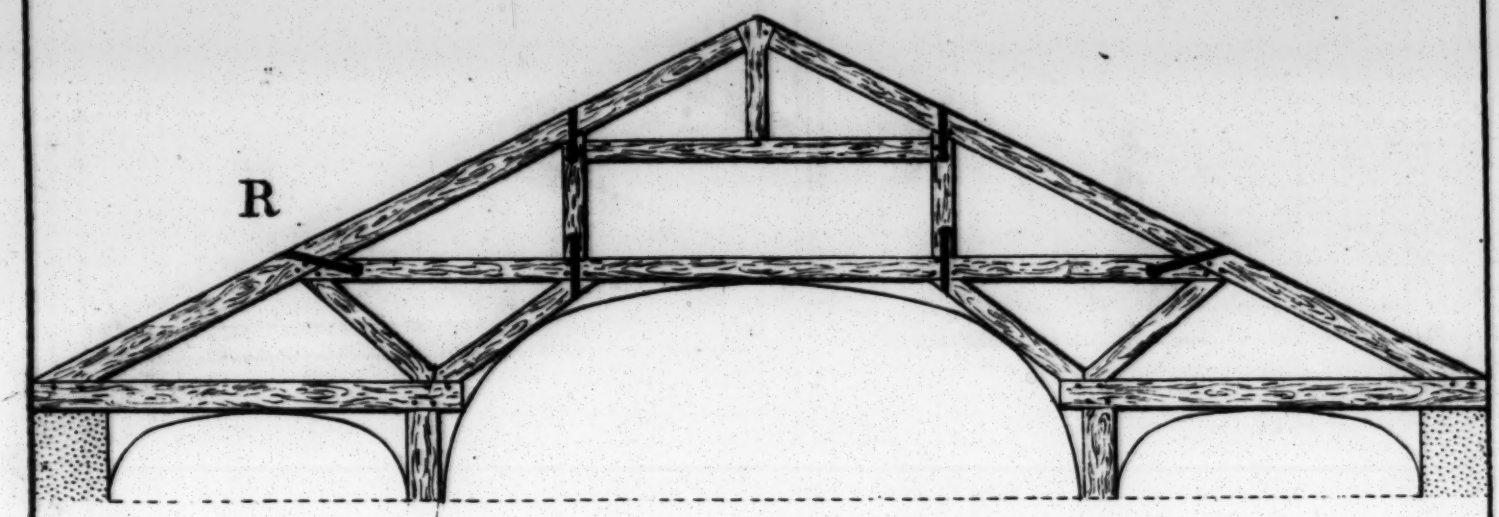
In that of T, the Middle Part is a Semi-Circle, and the Sides are a Segment, or Part of a Circle; but theſe may be varied at pleaſure. This Truſs ſeems ſuited to ſpan a greater Width than either of the others.

It may be ſaid of theſe and the foregoing, without Oſtentation, that they have each a very juſt Bearing, and done with as little Stuff and Labour as any that has as yet been perform'd, tho' differing in ſome Particulars.

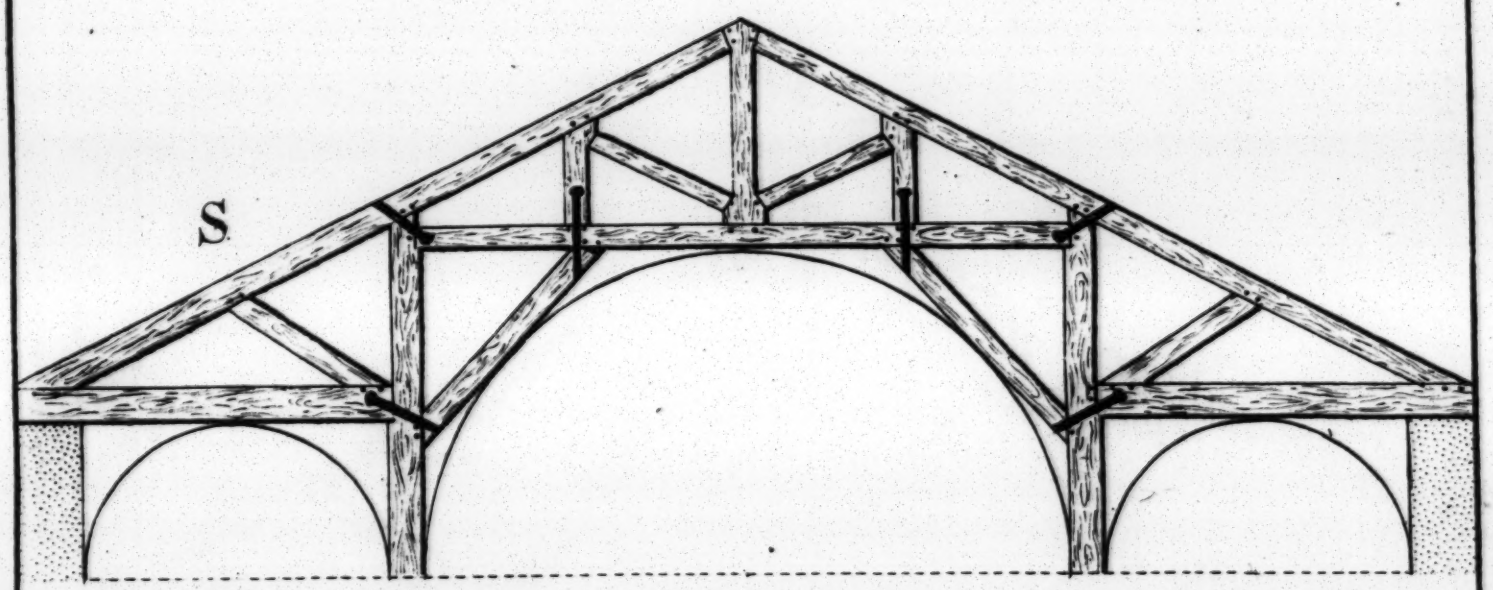
As to the Scantlings of Timber, I ſhall refer you to the Inſpectional Table, at the End of this Treatiſe, both for theſe and the foregoing Truſſes, as well as thoſe in the PLATES that follow.

Plate M.

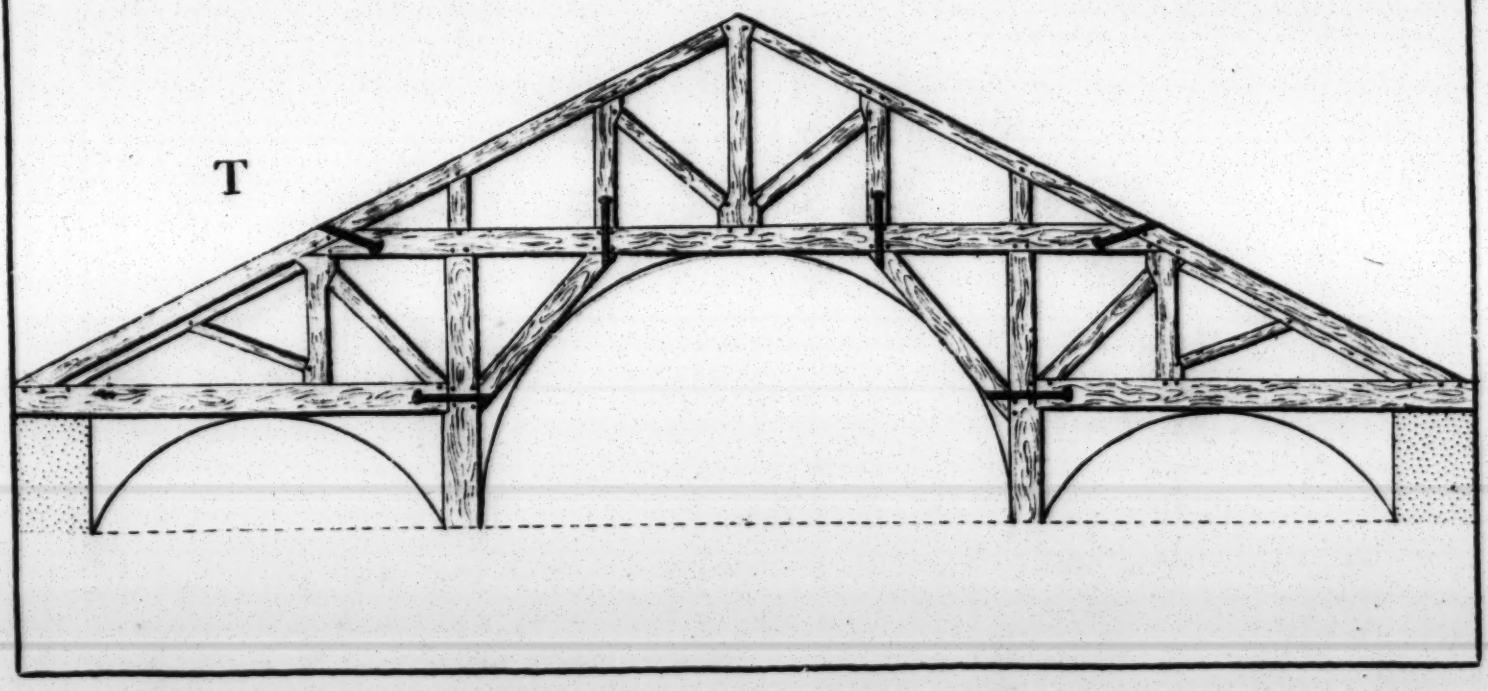
R



S



T



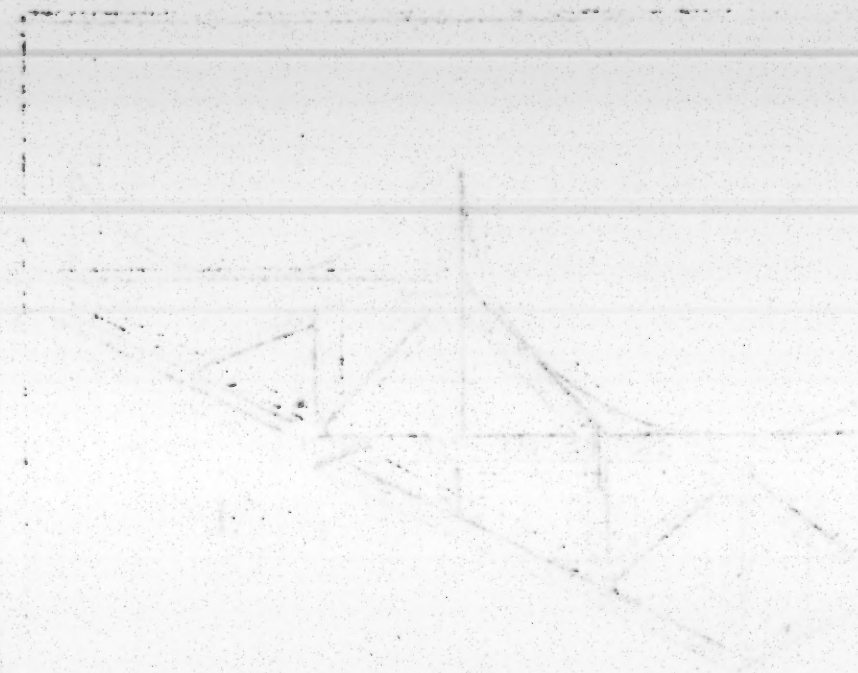
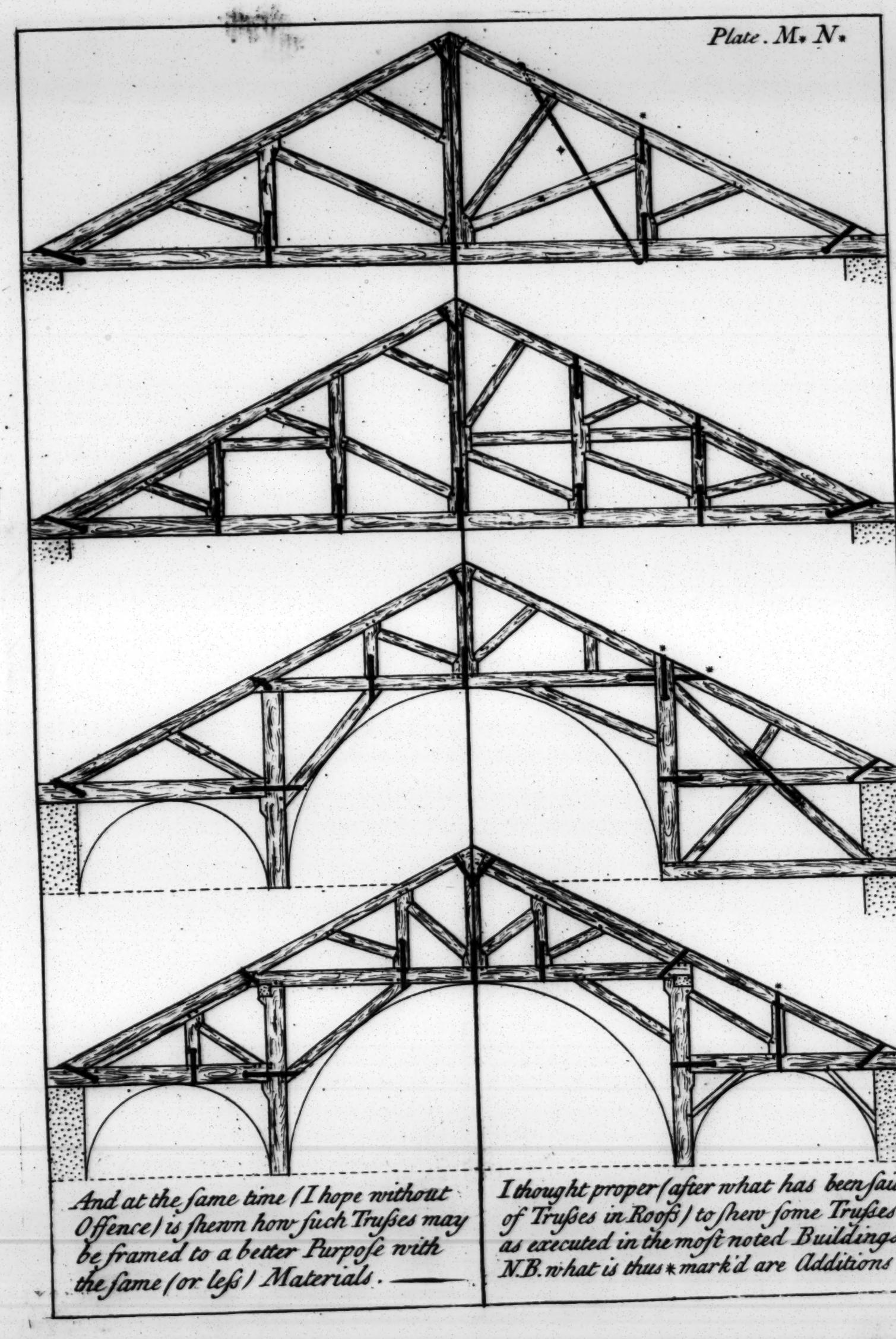


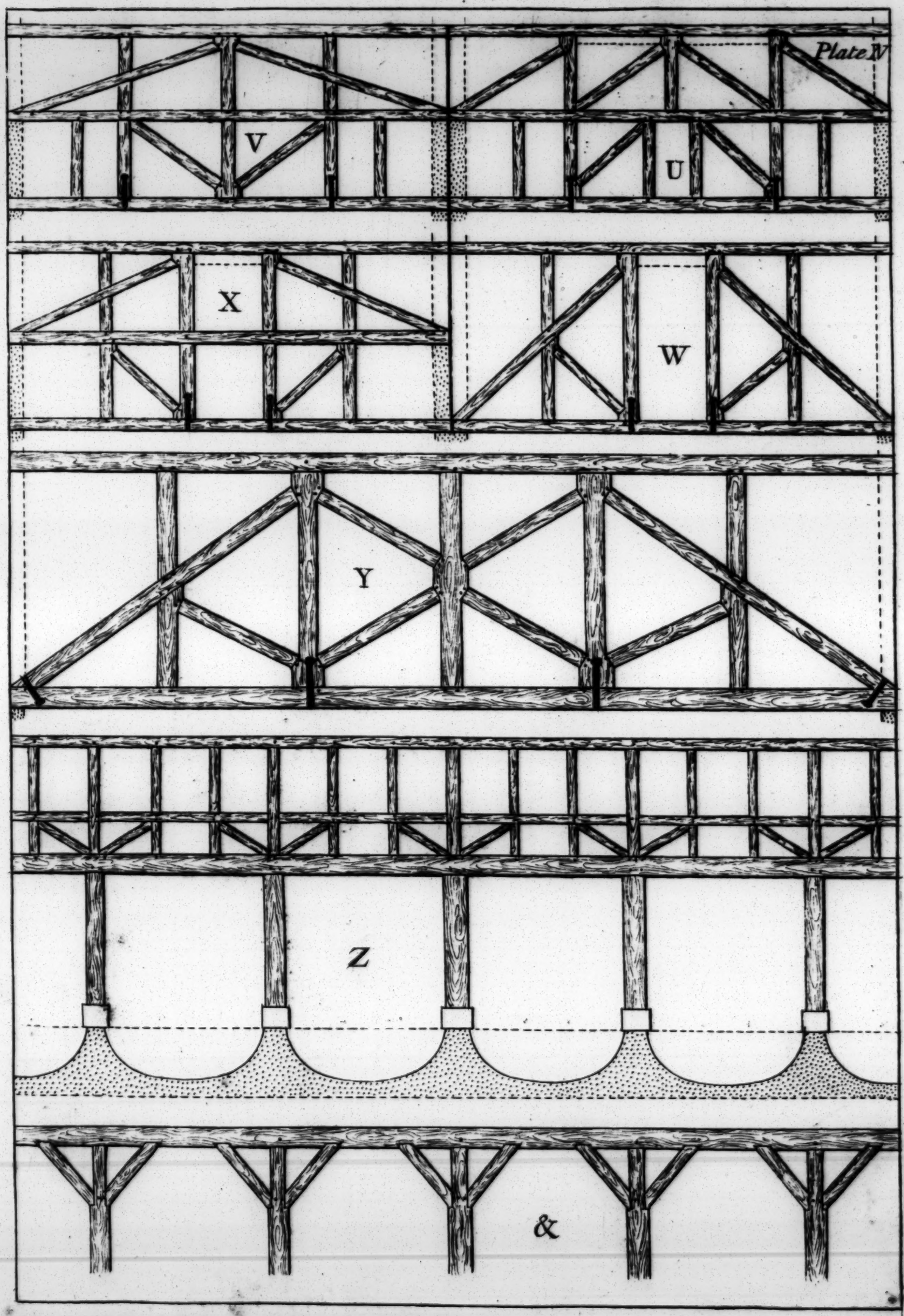
Plate. M. N.



And at the same time (I hope without Offence) is shewn how such Trusses may be framed to a better Purpose with the same (or less) Materials. ——

*I thought proper (after what has been said of Trusses in Roofs) to shew some Trusses as executed in the most noted Buildings N.B. what is thus * mark'd are Additions.*

Plate IV



NOTWITHSTANDING what has been ſaid of Truſſes in Roofs, thoſe of Partitions vary from them in ſome Parts; as here in Halving ſome Timbers together, that is, Letting one into the other, half of the Thickneſs of each, ſo that both the Sides are Even or Fluſh; and which I would never adviſe, without Neceſſity require it; becauſe this Method weakens the Timber, and renders it leſs capable of Support.

In V, is ſhewn a Partition, ſuppoſed to be between Rooms, in which Door-Ways, are wanted, as towards each Wall. And here the Inter-Ties, and King-Poſt, and prick'd Poſts, muſt be Halved together, but not the Braces, on no Terms.

In U, is alſo a Partition between Rooms, having three Door-Ways, one in the Middle, and one to each Wall. This alſo muſt be Halved together; that is, the two King-Poſts and Inter-Ties, but the Braces are Whole.

In W, and X, are ſhewn two more Partitions, with Door-Ways in them. And this Method I approve; becauſe, when the Building is ſettled, you may raiſe the Partitions with Shores, and by driving in freſh Struts yet longer, as the prick'd Lines ſhew, you may keep it to its proper Height.

In Y, is a Partition ſuppoſed to bear a Gutter, or Girders; or may bear a Wall, by having Timber in Proportion to its Uſe.

In Z, is ſhewn the Manner of a Timber Front, ſuppoſed to be open underneath in Form of an Arcade. And for ſuch Open Fronts, the Foundation ſhould be laid in Reverſed Arches, which will ſtrengthen it very much; by this means, the Ground bears between one Poſt or Pillar and the other, as well as under the ſame.

If on it you would have Brick-Work, or even Stone, then ſupport the Breſt-Summer, as is ſhewn in &: Which manner of Framing renders it as ſtrong between the Poſts, or Pillars, as it is directly on the ſame. And this is ſufficient for Proper Bearings.

NOT Only Partitions, but Bridges, require Timber to be Halved together; more eſpecially ſuch as extend a conſiderable Length. And becauſe theſe Timber-Bridges have never been intelligibly explain'd, therefore I hope the following will be kindly receiv'd.

Let A *, be the Plan, ſuppoſed to extend any Length not exceeding one hundred Feet, nor twenty four Feet in Width; alſo let B*, be the Side, or Upright of the ſame; and let C *, be the Section of the ſame by a larger Scale.

Leſt every one ſhould not conceive the Particulars by Inſpection, obſerve in A *, that a, a, a, a, are the Butment, or Support to each Shore; and let b, b, be the Tying-Beams, which are Halved into the Poſts; alſo let c, c, be the Bearing-Beams; and let d, d, d, d, be the Binding-Joiſts, which are let into the Bearing-Beams, (*as ſhewn in* PLATE C * D *, *at* T *); alſo let e, e, e, e, be the Plan of the ſeveral King-Poſts.

And in B*, obſerve that f, f, is the Top of the Water, at its common Level, and let g, g, be the Butments, or Support to each Shore; alſo let h, h, be the Tying-Beam, as Halved into the Poſts; let i, i, be the Plate for the Braces, l, l, to reſt on, which ſupport the Poſts k, k; ſo do the Braces m, m, diſcharge the whole Weight; alſo let n, n, be Struts to help the Strength, as by butting againſt each Brace; let o, o, o, be the Top-Plate, or Rail, and p, p, a Plank Weathered to throw the Water off.

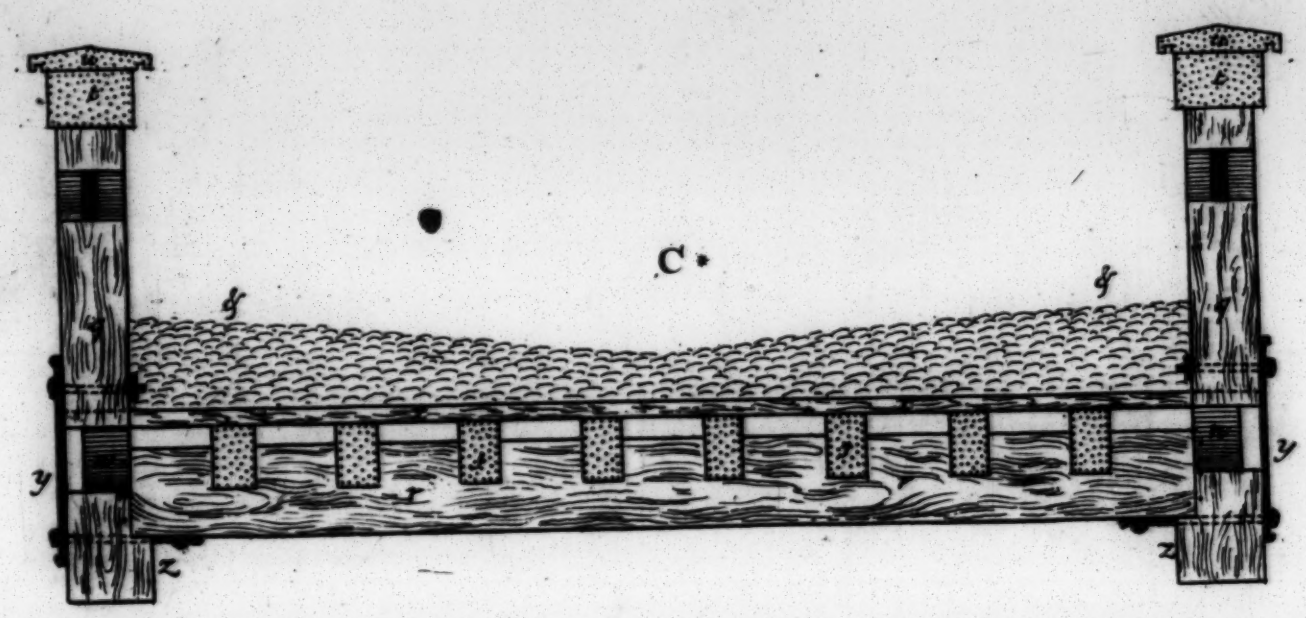
N. B. *The additional Beams*, &c. &c. *do add prodigiouſly to its Strength.*

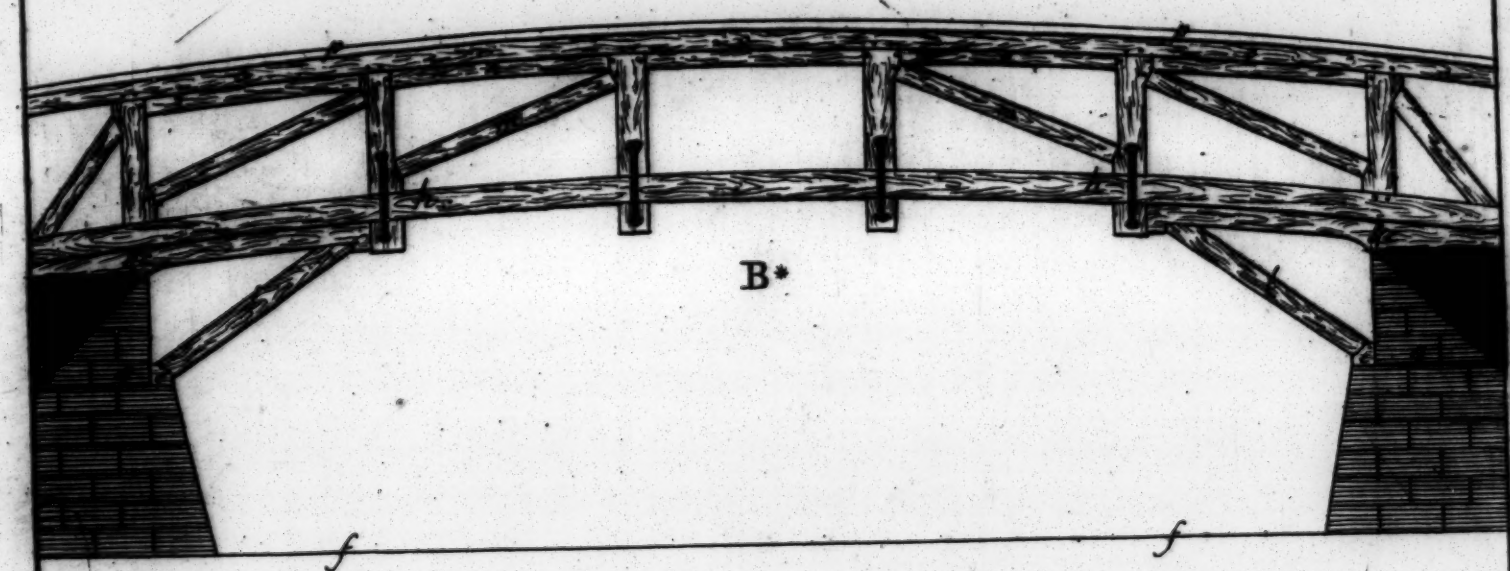
And in C*, which is the Section by a larger Scale, let q, q, be the Poſts, and r, r, the Bearing-Beam, framed therein, and let s, s, be the Binding-Joiſts; alſo let t, t, be the Top-Rail, being wider than the reſt to preſerve the Joynts the better, and let u, u, be the ſaid Plank Weather'd to throw the Water off yet better, as at w, w. It is neceſſary to let the Tying-Beam into the Poſts, a ſmall Matter, becauſe the Plank x, x, bears on it, as well as on the Binding-Joiſts; let y, y, be Straps of Iron bolted through the Poſts, in order to ſtrengthen the ſame; the lower Bolt goes through the ſaid Strap, and comes under the Bearing-Beam, and which with the Joggle z, z, preſerves a good Bearing for the Beam, which ought to be truſs'd, as ſhewn in PLATE B; and, &, &, is the Gravel, and Paving.

To preſerve the Timber the better, let the Truſs B *, be Boarded on each Side.

PLATE

Plate N.° 0.





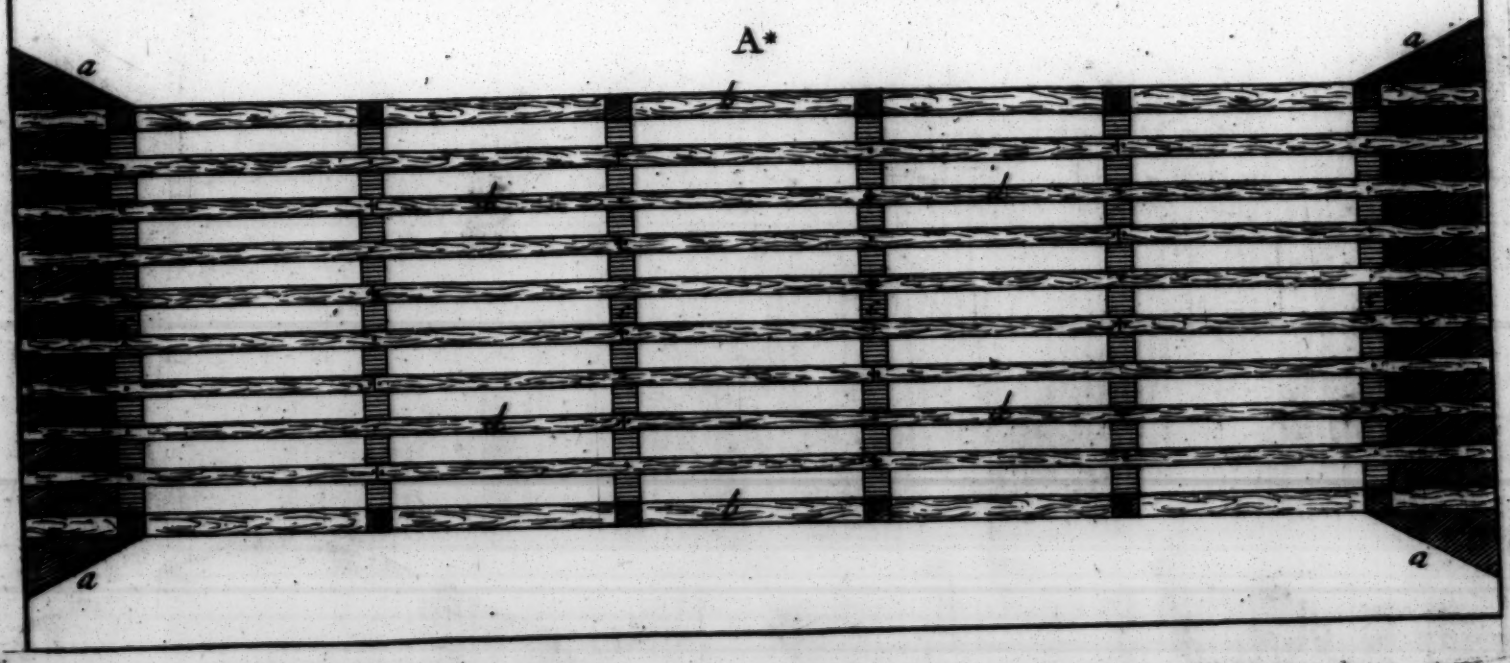
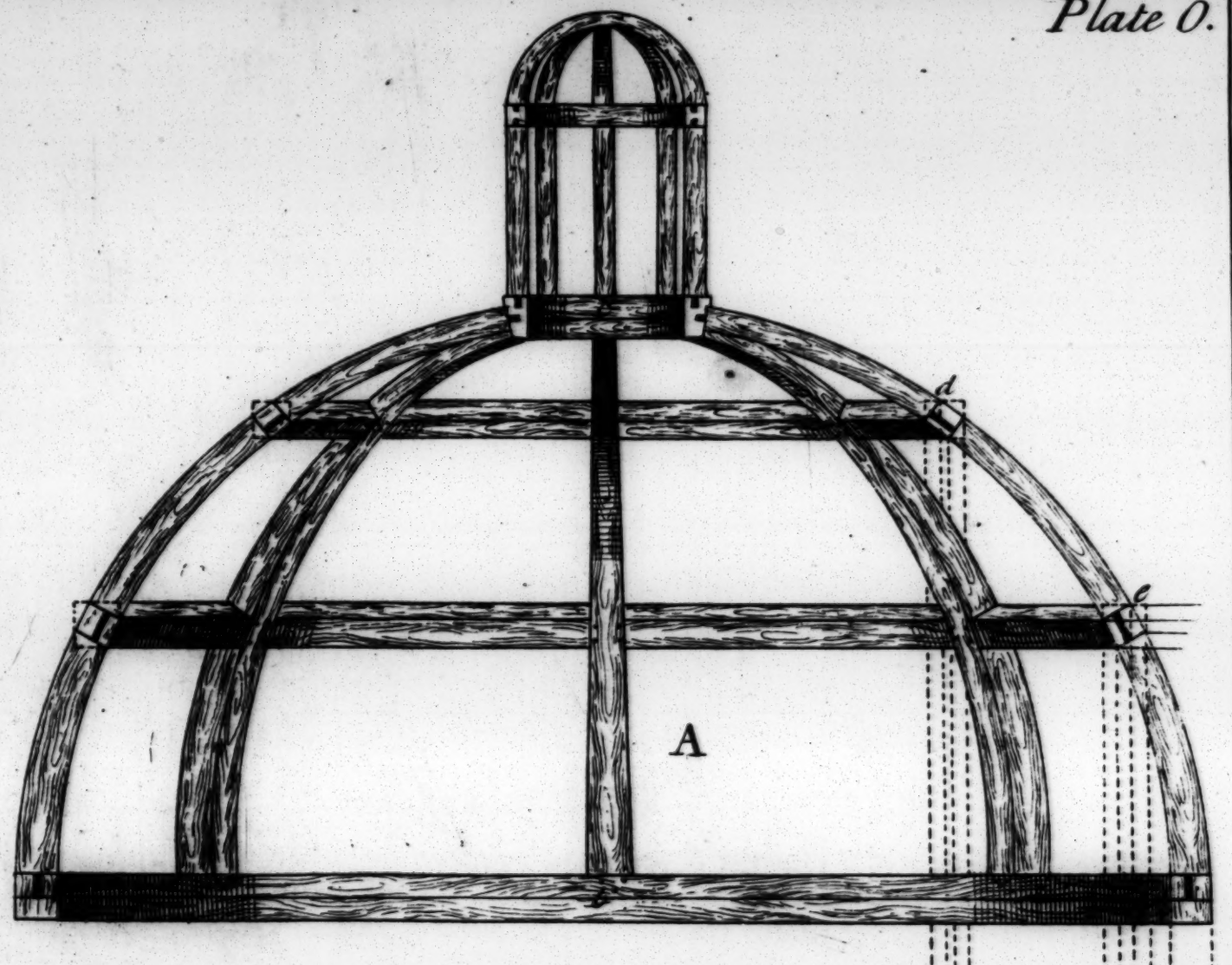
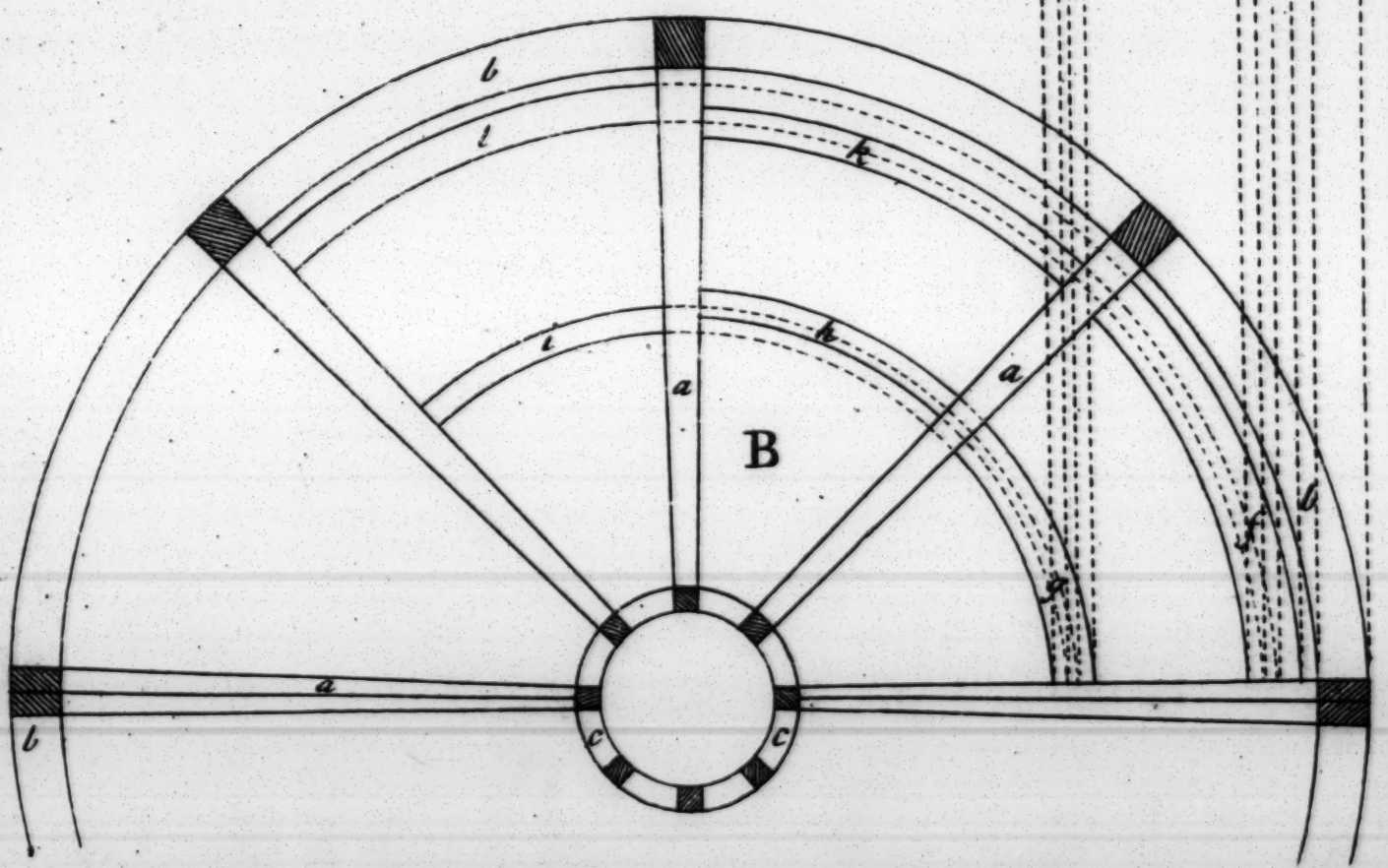


Plate O.





OF what has hitherto been deſcribed, nothing appears ſo beautiful when done, as Domes, or Circular Rooſs; and, as far as I can perceive, Nothing has appear'd ſo difficult in doing. Therefore it will be proper to ſpeak ſomething of them.

Let B, repreſent a Plan: In which let b, b, b, be the Plate on the ſuppoſed Wall; and let c, c, c, be the Kirb, on which ſtands a Lanthorn, or Cupola; alſo let a, a, a, repreſent the principal Ribs.

From the Plan B, make the Section A; in which the Kirb, or Plate b, ſhould be in two Thickneſſes; as alſo that of c; by which it is made ſtronger: And indeed the principal Ribs would be much better to be in two Thickneſſes. The beſt Timber for this Uſe, is *Engliſh* Oak, becauſe abundance of that naturally grows crooked. As to the Curve or Sweep of this Dome A, it is a Semi-Circle; altho' in that Point, every one may uſe his pleaſure. And in it are deſcribed the Purlins d, e, from which Perpendiculars are drop'd to the Plan B; ſo that f, is the Mould the lower Purlins are to be cut out by, before they are ſhaped or ſquared for Uſe; and that of g, is the Mould for the upper Purlins. I rather ſhew it with Purlins, becauſe under this Head may be ſhewn the Manner of Circular Roofs in Form of a Cone.

To ſhape or ſquare theſe Purlins, obſerve in A, as at d, and e, they are ſo ſquared, that the Joynts of the ſuppoſed ſmall Ribs are equal. Obſerve, as at e, the Corners of the Purlin, from which the Perpendiculars are let fall to the Plan B. So that your Purlin being firſt cut out to the Thickneſs required, as appears in e; and alſo to the Sweep f; ſo that k, is the Mould for the Bottom, and l, the Mould for the Top; by which, and the Lines from the Corners of the ſaid Purlin e, the ſame may be truly ſhaped or ſquared.

And for the Purlin d, in the Section A, Perpendiculars are drop'd to the Plan B. And in which it appears that h, is the Mould for the Top, and i, the Mould for the Bottom; ſo may this alſo be ſquared, which completes the Performance. If any ſhould ſay a Dome, cannot be done ſo ſafe without a Cavity as uſual, let them view St. *Stephen's Walbrook*, *Stocks-Market*, built by that Great Architect Sir *Chriſtopher Wren.*

PROPOSING in this PLATE to ſhew the Manner of Covering Lanthorns, or Cupolas;

Let A, be a Plan, the upper Part of which is made Half an Octagon, by PROPOSITION S.

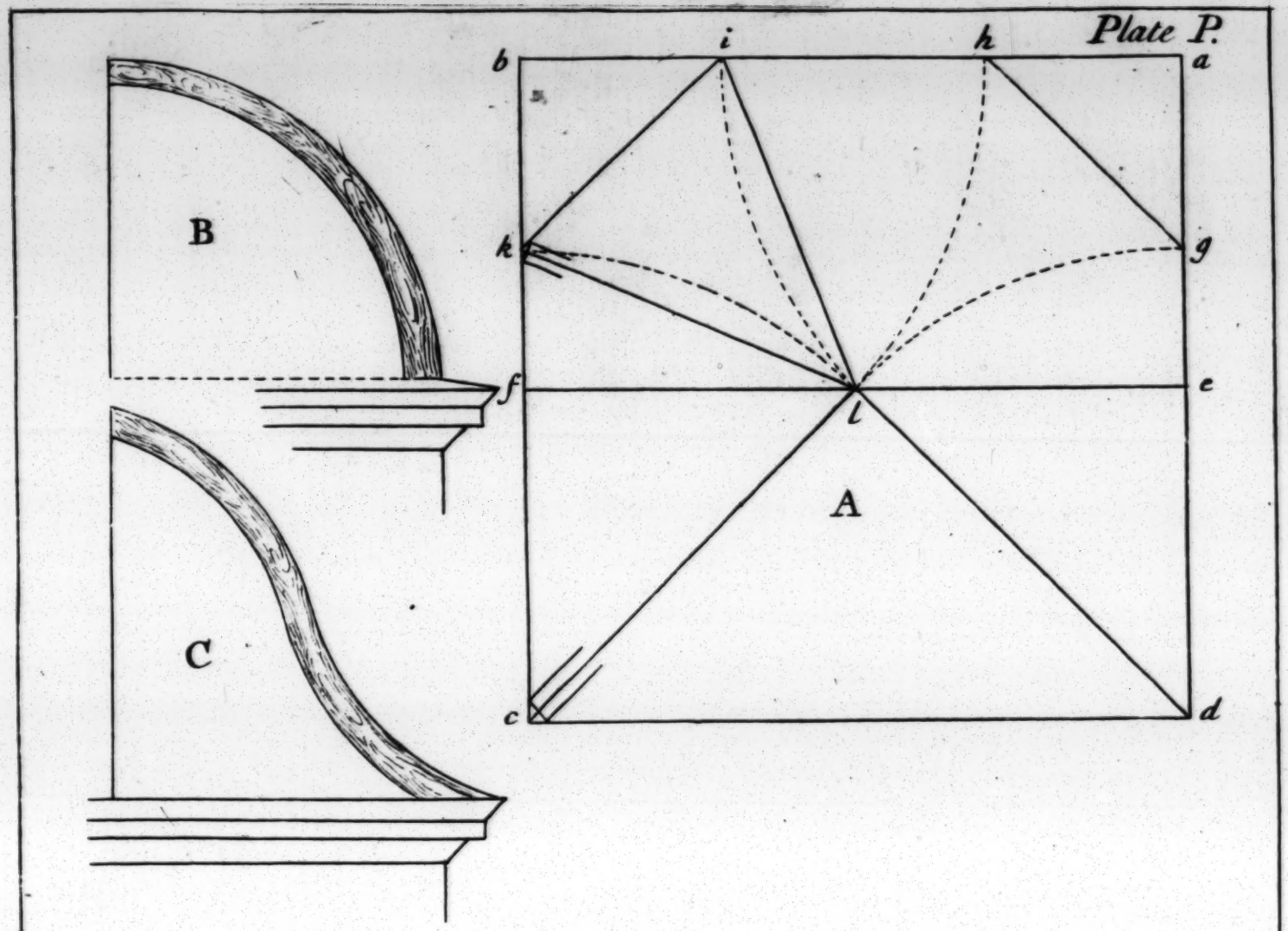
It is obſervable, that a Circular Roof, as B, ſhould extend no farther than the Upright of its Support, and there made ſo as to carry off the Water; whereas an O G, Roof, as C, may extend to the Extremity of the Cornice, without Injury to its Strength, or Offence to the Eye of the moſt curious. Alſo a hollow Roof, as D, may extend to the Extremity of the Cornice.

It appears to me, that the many Angles of a Cupola give it Beauty; therefore the Sweep E, is a regular Curve, the Baſe Line l, k, being taken from the Angle of the Octagon in the Plan A, as at l, k. This Curve E, is divided into a Number of equal Parts. In order to trace the common Rib F, from the ſaid angular Rib E, obſerve in A, the Baſe of the common Rib f, l, which is ſet in F, as from l, to f; continue the Perpendicular l, at pleaſure; take the Baſe l, k, in E, on which are the Perpendiculars drop'd from the Curve, and obſerve to place that Diſtance k, l, in E, from f, in F, to any Part where it cuts the Perpendicular l, in F, as at m; from thoſe Diviſions raiſe Perpendiculars. So by continuing Baſe Lines, from the Diviſions in E, to theſe Perpendiculars in F, their Interſection, or Meeting, is a Curve or Sweep exactly agreeable; and which indeed may ſerve as a Standard Rule to trace any Moulding whatever.

To Back the ſaid angular Bracket D, obſerve to deſcribe the Thickneſs of it on your Plan, as in A, at k; which ſhews how much your Mould muſt be ſhifted, as may appear in D. This alſo may be obſerved to be a general Rule for the Backing of any Bracket.

In G, is the angular Bracket of an O G, Roof, taken from the Plan A; as at l, c. And H, is the common Rib, or Bracket l, f, traced from G, as above is ſhewn. As alſo the Manner of Backing the Hip G, which appears by Inſpection.

Plate P.



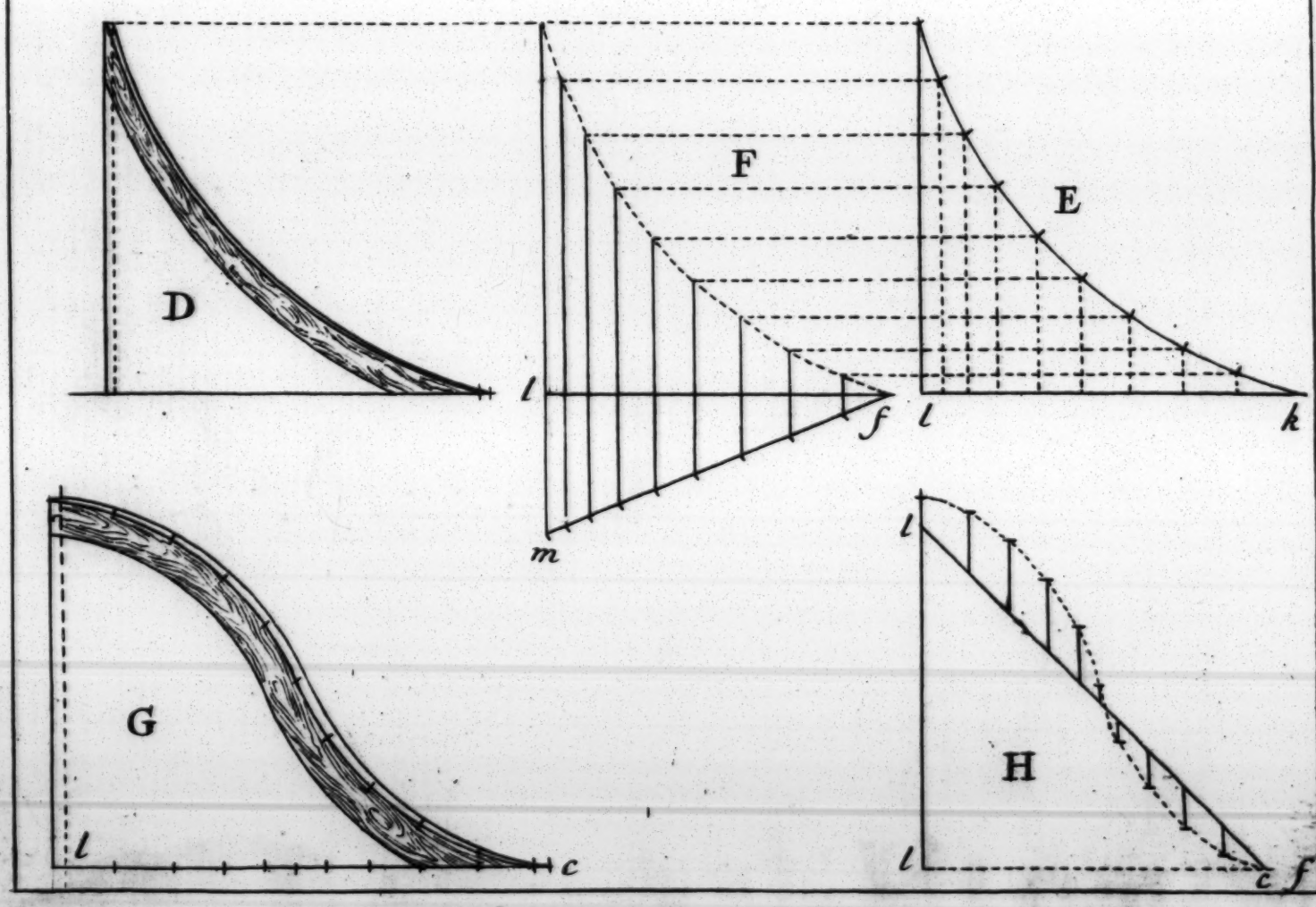
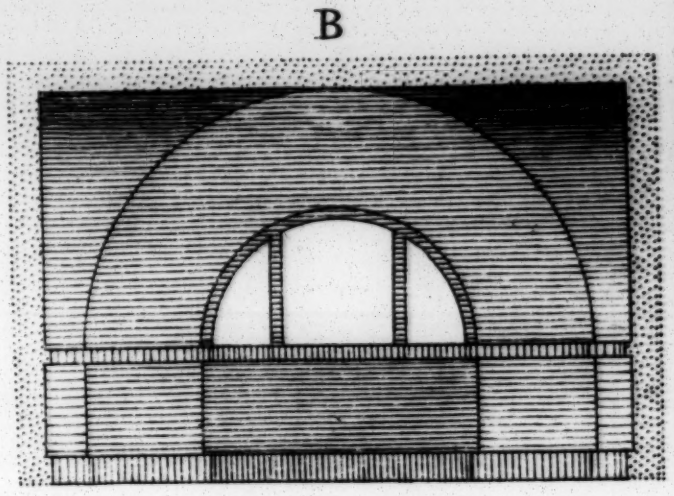
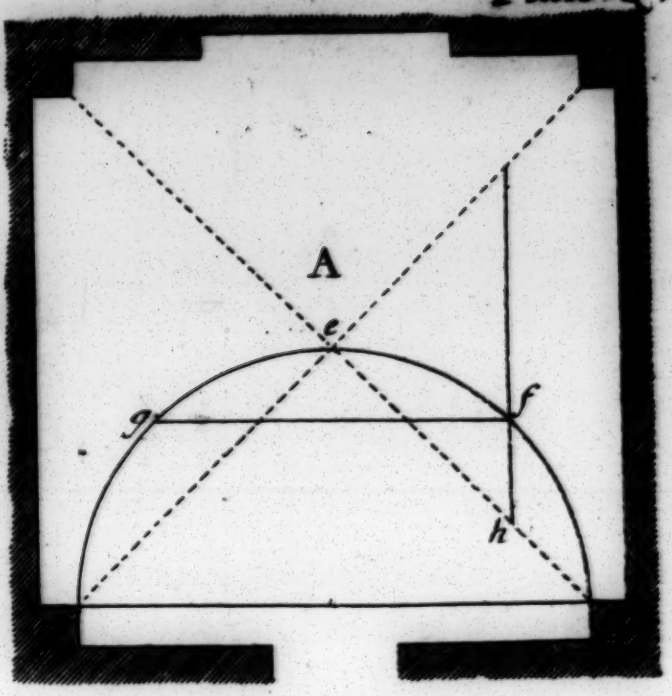
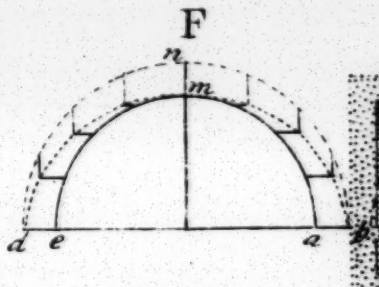
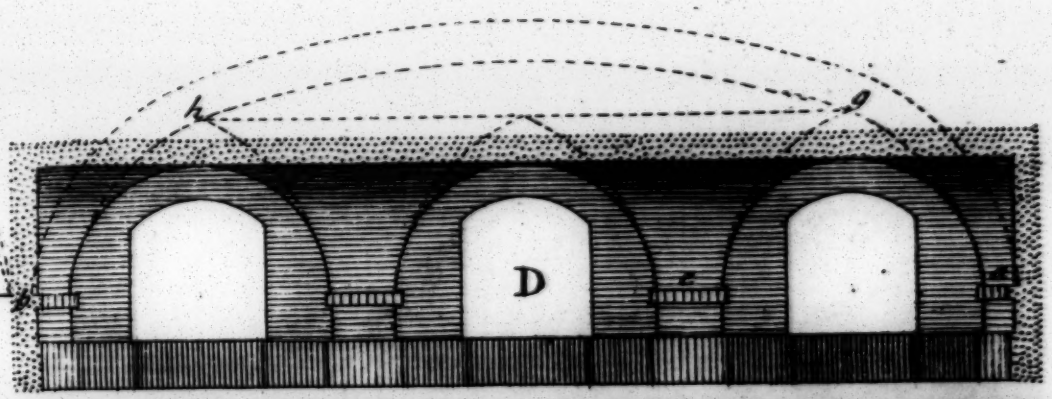


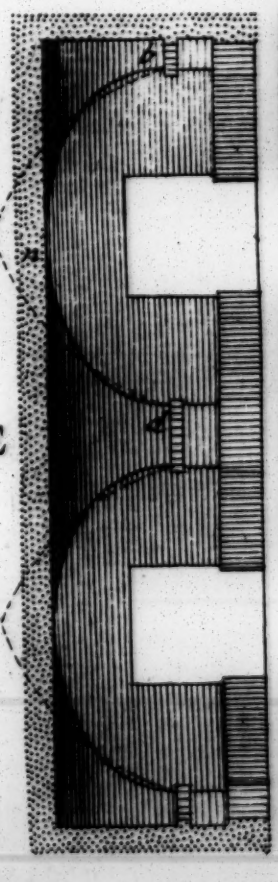
Plate Q.

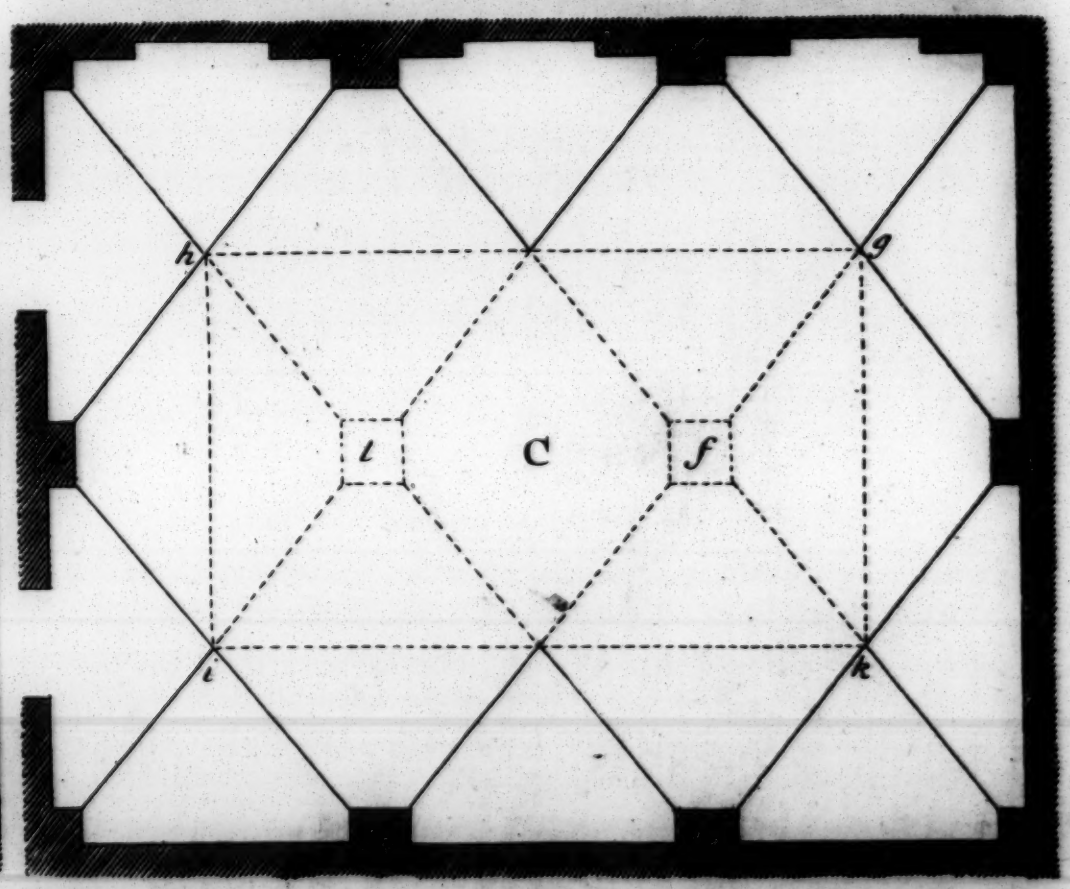












QUITE ſatisfied with what has been treated of, as to the Roof or Cover; I think it is proper now to ſhew the Nature of Centering.

Let A, be a Plan of a Vault to be centered for Groins. At a, b, c, d, are Piers, generally prepared to bear the Weight of the Brick-Work. At d, c, reſolve on the Curve you would have; as here a Semi-Circle, which is ſhewn by the Section B. Begin in A, at d, e, c; Center it through, as if it were a Common-Vault, and Board it; which being done to make your Groin, ſet Centers, as from a, to c, and from b, to d; divide the Curve d, e, c, into four equal Parts, as at g, and f; ſo is g, e, f, ſmall Centers you will want to nail on the Centers firſt boarded, whoſe Place or Plan is at h; theſe ſmall Centers may be put in at pleaſure, according to the Bearing of your Boards, that is, as to their Diſtance from each Center. To make your Groin ſtreight on its Baſe, at ſome little Height over the Centers, ſtrain a Line from b, to c, or d, to a; from which drop Perpendiculars on your Boarding, firſt fix'd at as many Places as you pleaſe, there drive in Nails, and bend a ſtreight Rod 'till it touch them all; and then with a Pencil, or Chalk, deſcribe the Curve ſo form'd, to which bring the Boards to be nailed on theſe little Centers, and their Joints will form a ſtreight Groin. If this ſhould be diſapproved, in the next PLATE is a more accurate Method.

Let C, be a Plan of greater Extent, and which ſuppoſe to be ſupported by two Piers, as f, l. In the Section D, it appears to be compoſed of entire Semi-Circles; then conſequently your Curves in the Section E, will be Elliptical, as b, m, d, and may be deſcribed with a Trammel, or traced (by PROPOSITION K) as in F, may appear. What was ſaid of A, explains this at one View.

If theſe Pillars ſhould be in the Way, view the Plan and Sections again. Firſt, form ſome principal Curve, as in D, at a, g, h, b; ſo that the Centers will be a Gothick Sweep; againſt the Windows, as e, g, a, trace the Curve d, h, b, in E, agreeable to e, g, a, in D, with which Center it, as ſhewn in A, and make good your Groins to the Sides: Laſtly, as appears in the Plan at g, h, i, k, make a flat Center, and fix it on your Centers before compleated, which, doubtleſs, due Inſpection will make plain; and hereby you avoid the Pillars, and are equally as firm.

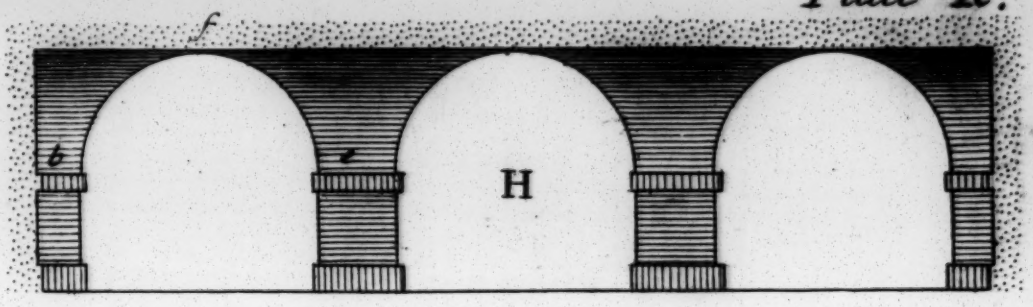
REGARDING Variety, I have given here another Method for Vaults of a large Extent, and which indeed may appear more intelligible than that in the foregoing PLATE.

View the Plan G, and its Section H, which is compoſed of entire Semi-Circles, as b, f, e. See alſo the Section I, which is an Ellipſis traced from b, f, e, in H: But for Uſe, nothing is more true than the Trammel, as ſhewn in PROPOSITIONS L, M. This, I ſuppoſe, is ſo plain as to need no Explanation, otherways than what was ſaid in the foregoing PLATE, as on *Fig.* A.

See this Plan again, and alſo its Section I, from which is deſcrib'd the Curvi-lineal Face K, and alſo the Face of the Semi-circular Arches, as L; all being alike. And this is what I call a more accurate Method for finding the Groin, ſo as to be ſtreight over its Baſe. The Curve in I, is divided regularly, tho' ſeemingly into unequal Parts, which being drawn to the Groin in the Plan G; as appears by the Figures 1, 2, 3, 4, 5, 6, 7, 8, 9; and which are transferr'd into L, at 1, 2, 3, 4, 5, 6, 7, 8, 9. Alſo the Circle b, f, e, in H, is divided into eighteen equal Parts; the Half, conſequently, into 1, 2, 3, 4, 5, 6, 7, 8, 9; which appears from b, to e, in L. This Method doubtleſs will be plain, and therefore needs no farther Explanation.

That of K, belongs to the Section I, extended as it were; and that of L, belongs to one of the ſmall Arches of H, alſo ſtretch'd out.

Plate R.



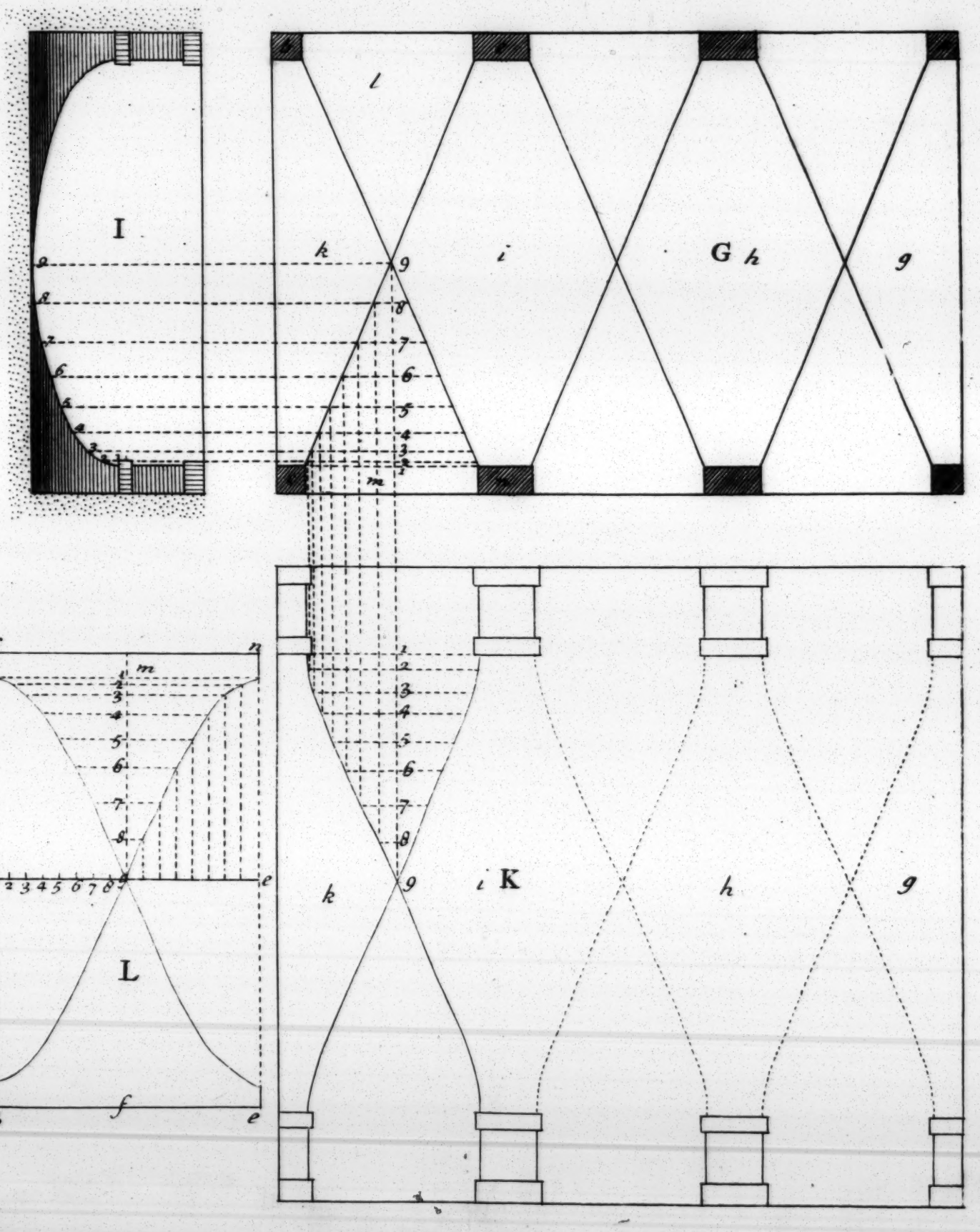
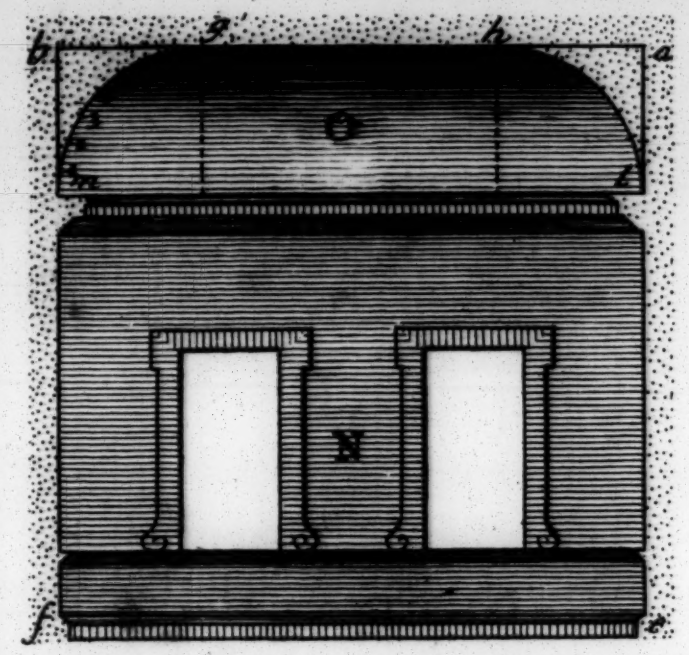


Plate S.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f
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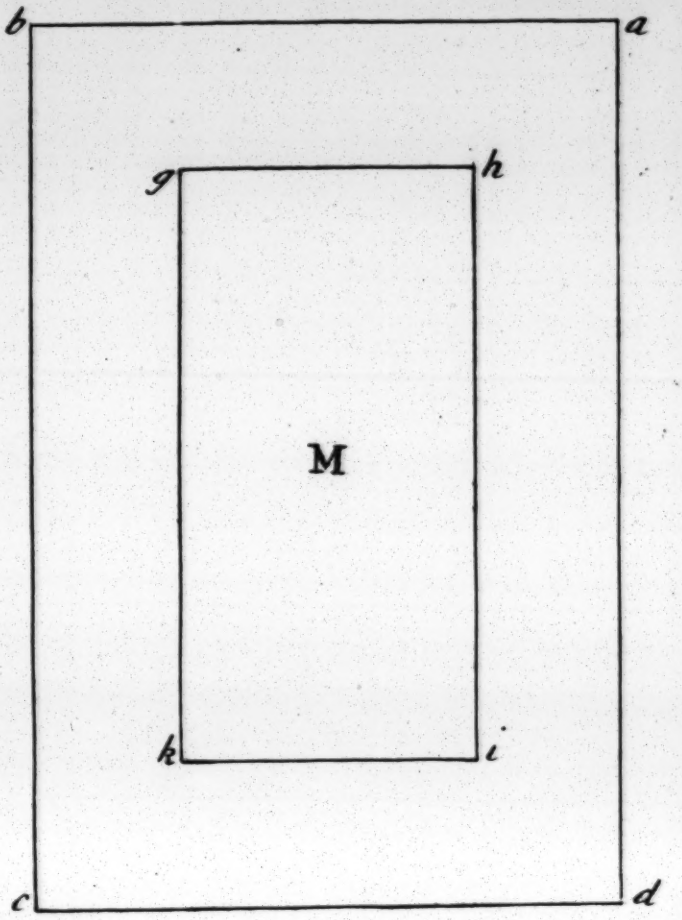
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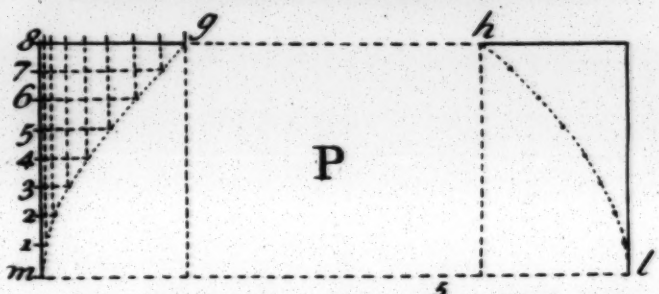
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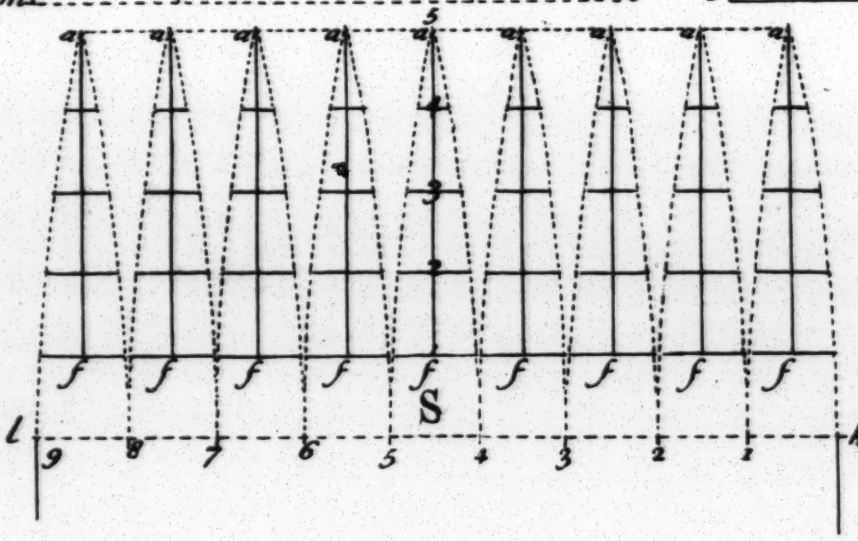
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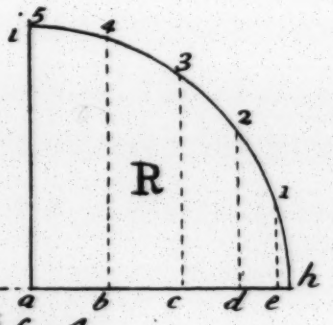
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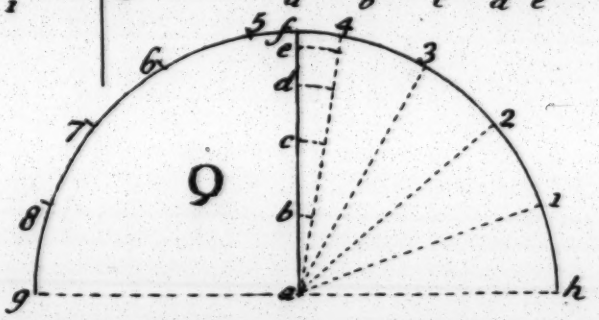
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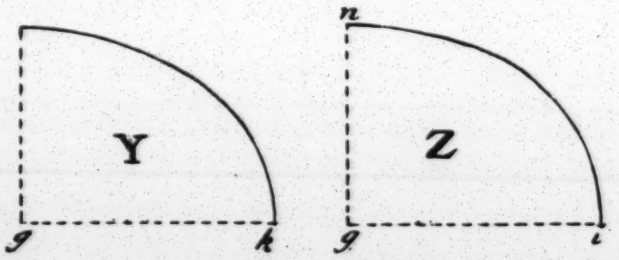
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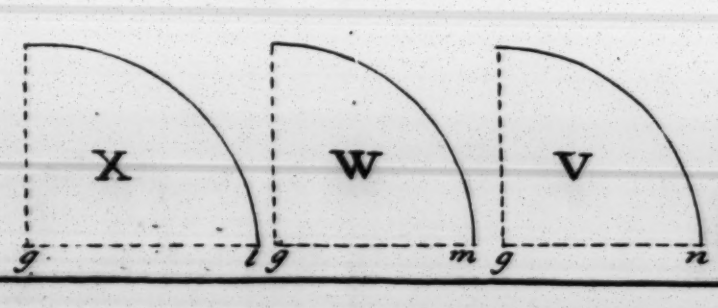
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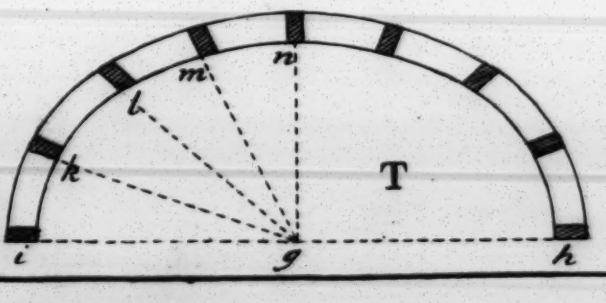
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SUPPOSE M, to be the Plan of a Cieling, as a, b, c, d; and in it, it is required to have a large Frame, or Pannel, as g, h, i, k.

Firſt produce ſome one Side, or End of the Room, as N. The Extent of the End of the ſaid Room, is a, b, f, e; and it is Coved one fourth of its Height, as m, b, The ſaid Frame or Pannel being g, h; the Quarter-Circle m, g, is divided into eight equal Parts, which are transferr'd to P; ſo that m, g, h, l, is the Face of O, as ſtretched, or extended out, on which any Thing propoſed to be deſcribed therein, may be truely perform'd.

In Q, is ſhewn the Plan of a Nich, or Dome. If a Nich, let it be demanded to be fineered with Walnut-tree, *&c.* If a Dome, let it be required to be cover'd with Lead. Divide it into any Number of Parts, as here into nine; which transfer to S, as appears from k, to l. Deſcribe the Section alſo, as R, being a Quarter-Circle, which divide into any Number of Parts, as here into five, as is ſhewn in the Figure from h, to i; which transfer in the Plan Q, from a, to f; Middle ſome one Diviſion, as from 4, to 5; then take thoſe Diſtances from R, and transfer them to S, as from f, to 5; ſo that each Diviſion is Halved, or Middled, as f, a; f, a; *&c.* on theſe Lines place the Diſtances from Q, as at e, d, c, b, to 1, 2, 3, 4, in S; and theſe will form ſuch Curves as ſhall meet.

N. B. The more Parts it is divided into, the better and truer it will be perform'd.

In T, is ſhewn the Plan of an Elliptical Nich; its Section is the ſame. In the Plan T, is ſhewn the Thickneſs of the Ribs (ſuppoſing it to be prepared for Plaiſtering) as i, k, l, m, n. The manner of forming their ſeveral Curves, as U, W, X, Y, Z, is beſt done with a TRAMMEL. Some of theſe Ribs muſt be ſloping, ſo as to require the Mould to be ſhifted, as has been before ſhewn, in PLATE P.

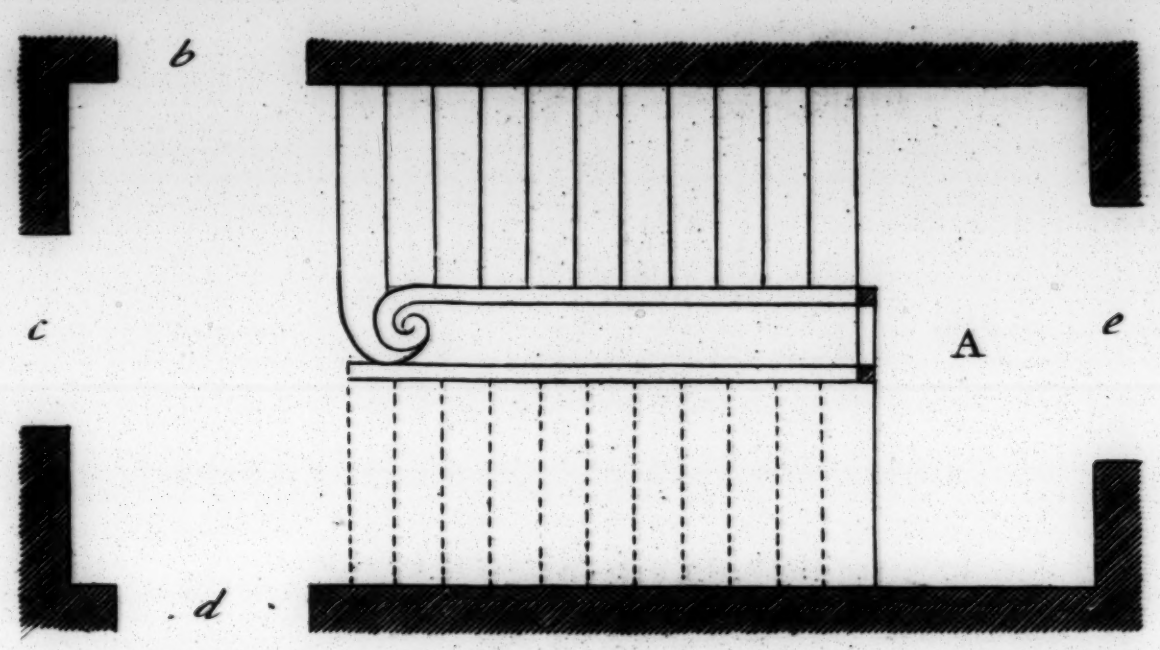
THINKING it may be agreeable to my Reader, I have choſe to explain ſome principal Matters in Stairs, ſuch as their Form, the Kneeling, and Ramp of their Rails, with a new and exact Method to Square a twiſted Rail, either for Stairs or other Uſes; which Point having never yet been fully clear'd, I hope it will be found uſeful.

Let A, be a Plan, or opening for Stairs, and b, c, d, be Door-Ways, and e, a Window to light the ſame. The firſt Thing to be conſidered, is the Height of the whole Story, or Floor; then form ſome Plan for the Landing the Steps, and the Half-pace; obſerving that the Riſe of each Step be not leſs than five Inches, nor more than ſeven: and that the Tread, or Breadth of the Step, be not leſs than nine Inches, nor more than fourteen: Theſe are beſt done on a Rod dividing them exactly. This Height or Riſe, and the Tread or Breadth of each Step, is call'd a Pitch-Board; which ſhall be hereafter ſhewn, with its Uſe: The Length of each Step may be any thing above three Feet, as the Place will allow. (Theſe are call'd Dog-leg'd-Stairs.

In B, is ſhewn an Open Newel Stair-Caſe; g, h, i, being a *Venetian* Window to light the ſame, and k, l, m, n, f, Door-Ways leading to, or from the ſaid Stairs. Theſe open newell'd Stairs may be lighted from above, ſuppoſing there is not a Conveniency for the Window, g, h, i.

It may be obſerved, that Stairs ought to be deſcribed, and accounted for juſtly, at the ſame Time a Plan of a Building is made, for want of which ſometimes unpardonable Errors have been committed: Such as having a little, blind Stair-Caſe to a large Houſe, or, on the other hand, to have a large ſpacious Stair-Caſe to a little one.

Plate T.



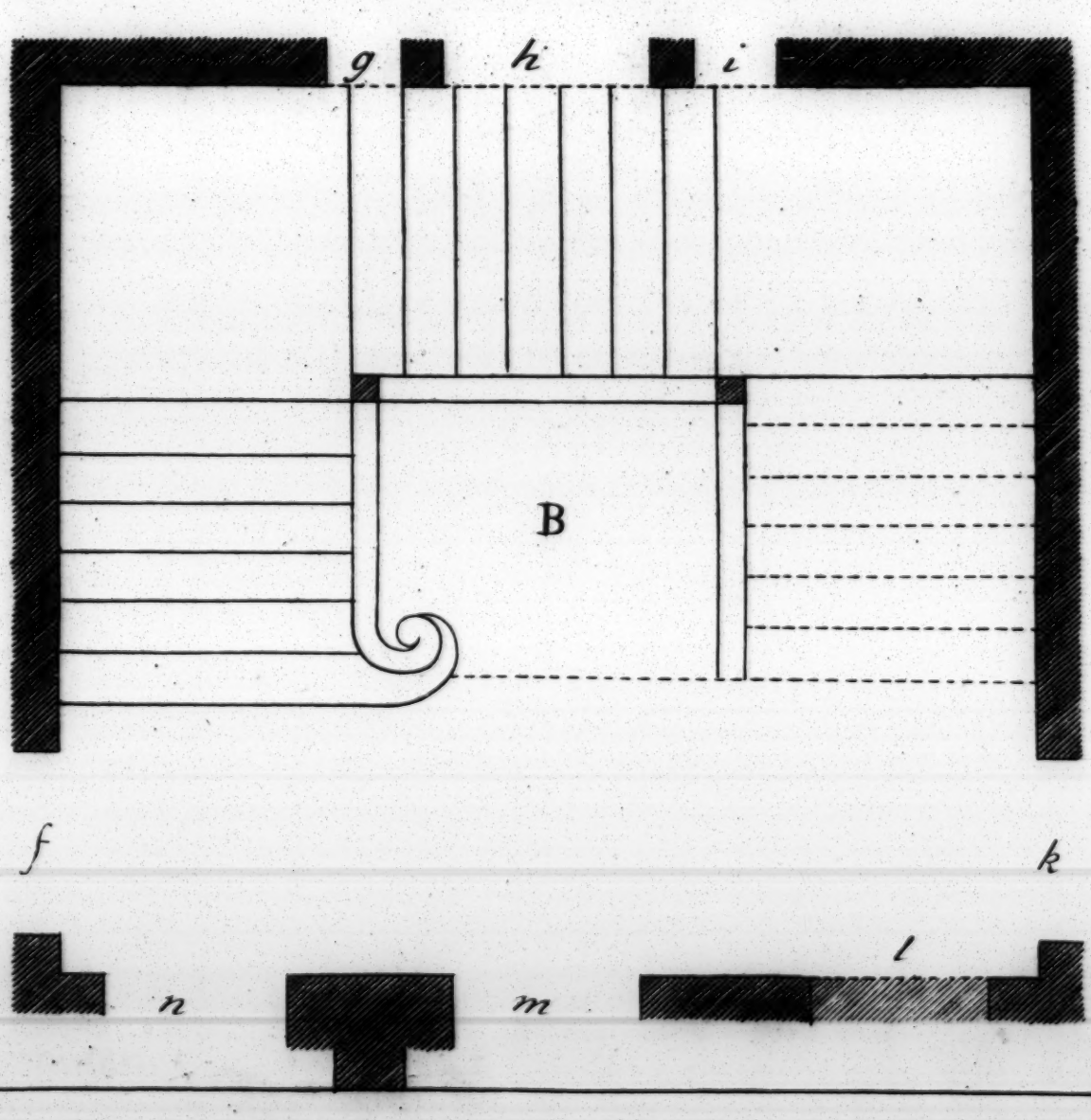
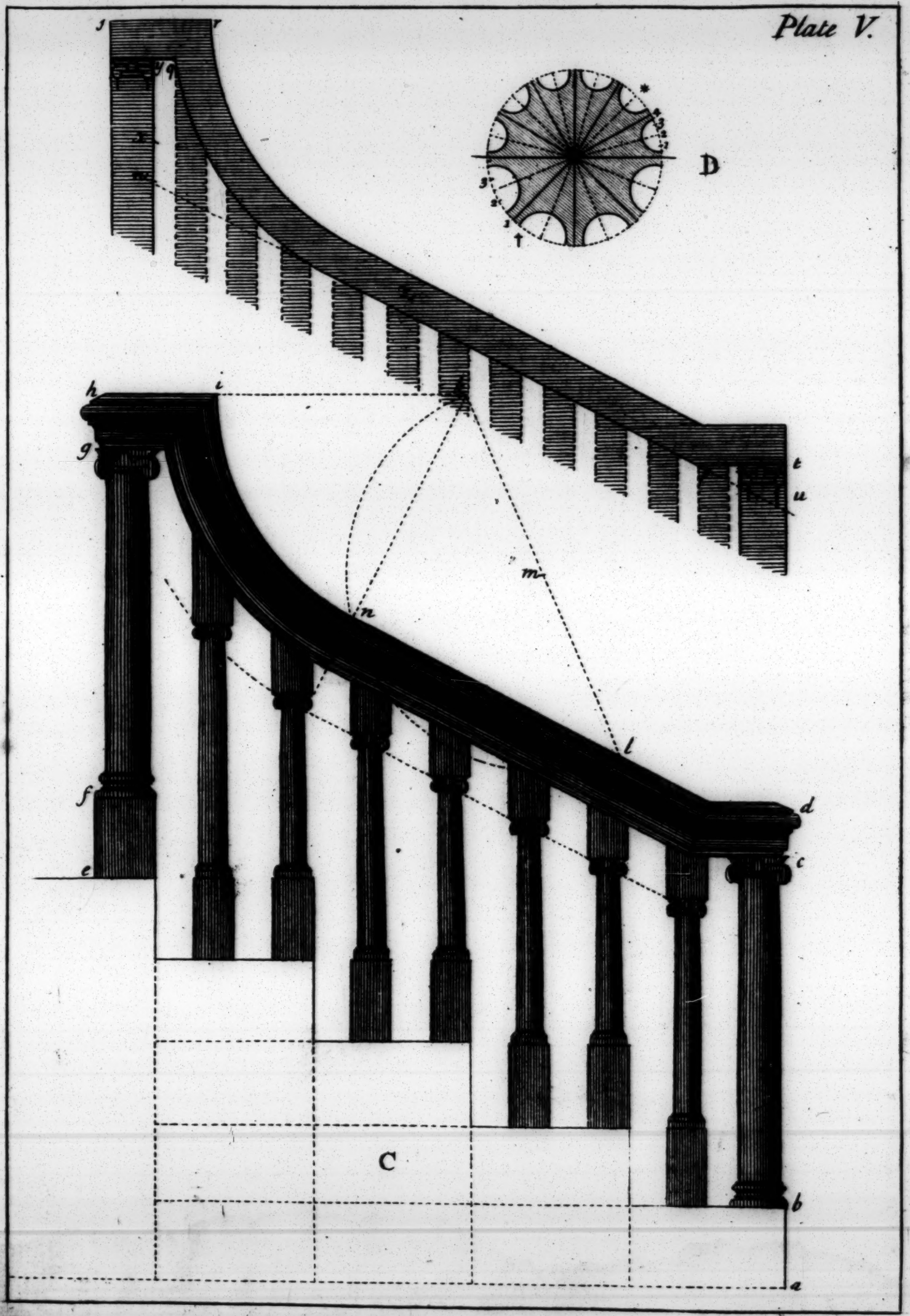


Plate V.



VERY probable, this Method may be known, tho' not practiſed.

To find the Kneeling and Ramp of Rails.

In C, is repreſented a ſhort Flight of four Steps, and Part of a Half-Pace, on which are ſhewn only two Balluſters on a Step; a, b, is the Riſe or Height of one Step, and b, c, is the Newel, generally two Feet four Inches and a Half high, and ſometimes two Feet ſix Inches high, &c. and c, d, is the Thickneſs of the Rail, the Kneeling o, is in the Middle of the firſt Balluſter; from e, to f, is alſo the Height of the firſt Step on the Half-Pace; and f, g, the Height of the Newel, agreeable to that of b, c, and g, h, is the Thickneſs of the Rail; from h, to i, is generally the ſame as from o, to c, which Line h, i, continue at pleaſure; for on it is the Center for the Ramp. With your Compaſſes find the Center k, which touches the Back of the Rail n, and the Point of the Ramp i; by PROPOSITION O, find the Point of Touch n; draw the Line k, n; deſcribe the Ramp, and alſo the turned Part of the Balluſters, as may be ſeen by the prick'd Line.

Over this, is repreſented the Alteration that ought to be made, if you ſet three Balluſters on a Step; that is, that the Kneeling ought to come to the Back-ſide of the firſt and laſt Balluſters, as at p, and q. If it be ſaid, the Method in Figure C, is not fully expreſs'd; To find the Height of the Ramp agreeable to the Kneeling, let Z, be the Rail, the Bottom is continued as by the prick'd Line appears at u, and w; take the Diſtance u, t, and ſet from w, to x; from x, ſet one Riſe, or the Height of one Step, as at y; and that gives the Height of the Ramp, and is the ſame as the Method in Figure C, notwithſtanding they differ in Appearance.

In D, is ſhewn the manner of Fluting Newels for Stairs, as *; and alſo Balluſters, as †; the Newel having twelve Flutes, and the Balluſters eight. If the Stuff be large, the Flutes may vary; as the Newels to have ſixteen Flutes, the Balluſters twelve; and in this Caſe, PROPOSITIONS Q, and R, may be uſeful.

WHATEVER may appear Difficult in this Method of forming Scroles proper for the Plans of twiſted Rails, due Application will make eaſy and expeditious.

Firſt, form a Scrole with Chalk, or a Pencil, agreeable to the Bigneſs of the Place in which it is to ſtand; next reſolve on the Bigneſs of your Stuff to be uſed, and alſo your Mouldings on the Side of the Rail, as in C. Let d, be the Center of your chalked Scrole in D; on which deſcribe, with the Projection of your Mouldings from C, the ſmall Circle d; take from C, half the Bigneſs of the Stuff, as e, g, or e, f, which add to the ſmall Circle, and form the Circle h, i, t; which is the Bigneſs of the Eye of the Scrole: This done, take the Diſtance from i, to the In-ſide of the Rail, as the ſuppoſed chalked Scrole, which ſuppoſe k; with it, make a diminiſhing Scale, by ſetting that Diſtance up, from t, to l; draw the Line k, l; place one Foot of your Compaſſes in k, deſcribe the Part of a Circle t, 8; which divide into eight equal Parts, becauſe here your ſuppoſed chalk'd Scrole was to come into its Eye, or Block, at one Revolution of a Circle. (Scroles may be made to any Number of Revolutions deſired, by the ſame Rule.) *Witneſs that above in Figure E.*

Place one Foot of your Compaſſes in d, deſcribe the large Circle w, l, l, u; which always divide into eight Parts, becauſe you ſtrike one eighth Part of a Circle every Time, till you come into the Eye, or Block i, t, h; from the ſaid Diviſions on the large Circle, draw Lines through, for on them your Sections meet, which form the Scrole. It is obſervable in drawing your Sections, that they don't end in the Line drawn through the great Circle, only the Out-ſide Scrole; for thoſe of the In-ſide Scrole end on a Line drawn to each reſpective Center. I ſuppoſe A, and B, to be two Steps; the reſt I think cannot fail of being underſtood, by obſerving the Letters and Figures, which ſhew each Part diſtinctly.

Plate W.

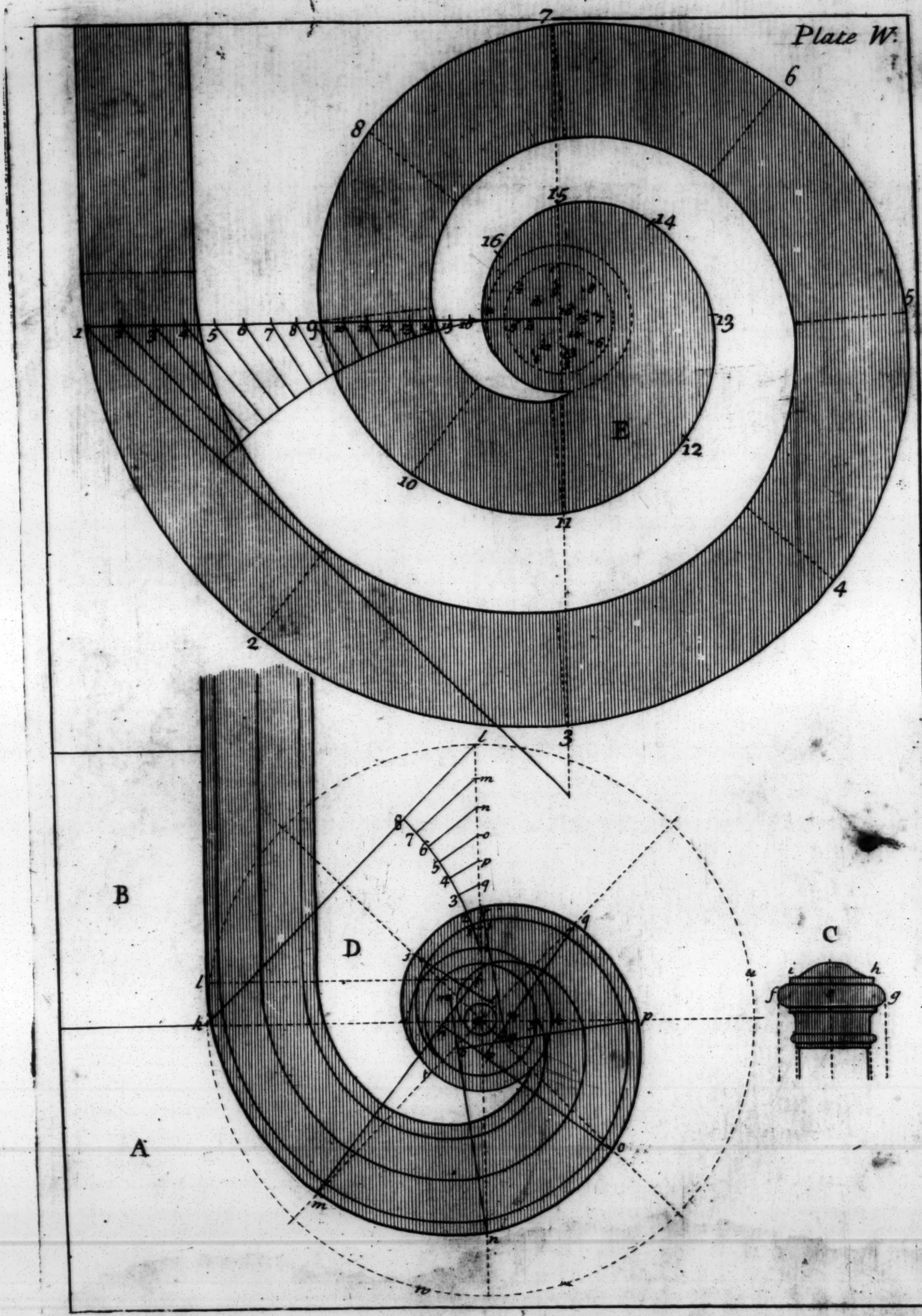
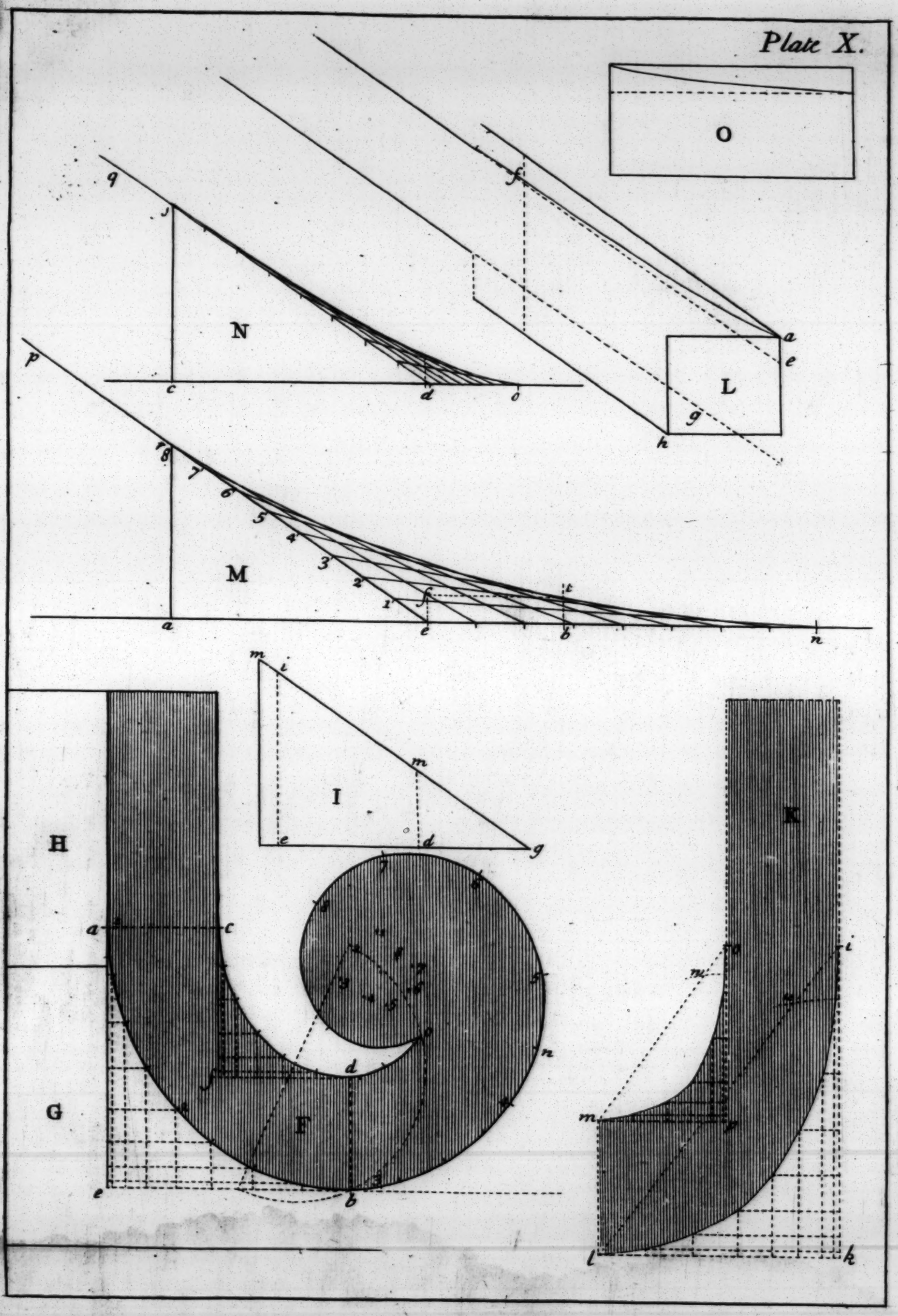


Plate X.



IN order to make the Squaring of a Twiſted-Rail eaſy, ſee the Plan F, which is the ſame as that in the foregoing PLATE; and by PROPOSITION O, find the Point of Touch b. Therefore a Mould muſt be traced out, in order to form a Sweep, which is to be applied on the Rake, agreeable to this of a, b, c, d, as that of K. It is firſt to be obſerved that you will want Wood extraordinary, both on the Top of the Rail, as in L, at e, a; and alſo under the ſame, as g, h. To find which, obſerve where your Sweep begins, in the Plan F, as at a, c; alſo obſerve that o, and n, is the End of the twiſted Part. Therefore from a, to n, divide into a Number of equal Parts, ſo as to transfer them on ſome Line, as in M, from a, to n; alſo divide the In-ſide of F, as from c, to o, into equal Parts, ſo as to transfer them on ſome Line, as in N, from c, to o; take the Diſtance e, a, in F; apply it to the Pitch-Board, as from g, to e; take the Pitch-Board I, with it place e, to c, in N; draw the Line d, q, and make the Point s; divide from d, to s, into eight equal Parts, alſo from d, to o, into the ſame Number; draw the Lines which forms a Sweep, whoſe Uſe ſhall be hereafter ſhewn.

Likewiſe take the Pitch-Board I, and apply e, to a, in M; draw the Line e, p, and make the Point r; from e, to r, divide into eight equal Parts; alſo from e, to n, do likewiſe; draw ſtreight Lines from each Diviſion: That Curve ſhews how much Wood is wanting on the Back of the Rail, as b, t, which deſcribe from e, to a, in L; and there deſcribe the Bigneſs of the Rail; which ſhews how much Wood is wanting, as may be obſerved by what was ſaid above. The other Part of the Twiſt is cut out of a parallel Piece, as O.

To Square the twiſted Part of the Rail, having ſo much Wood extraordinary on the Top and Bottom, obſerve in F, from a, to e, and from c, to f, muſt be traced. Take a, e, in F, apply it to the Pitch-Board I, it ſhews g, i, which place in K, from k, to i; alſo take from F, the Diſtance b, d, apply it to the Pitch-Board I, it ſhews g, m, which place in K, from l, to m. This done, trace out the Raking Mould K, agreeable to the Plan F, by the Method before ſhewn, which in this is plain by Inſpection, and a little Practice, without which nothing is known truely. I ſay the Wood extraordinary being accounted for in L, both the Top and the Bottom of the Rail, obſerve to place your Stroke f, in its true Place, that is, at the Beginning of the twiſted Part; take the Raking Mould K, ſet i, to f, in L; there ſtrike it by; with the Angle of your Pitch-Board deſcribe the prick'd Line f; at the Bottom of the Rail apply the Mould K; ſet i, to this prick'd Line, and there deſcribe it by, with your Pencil; laſtly, cut that Wood away; alſo cut the remaining Part of the Scrole out of the Block, as O; then, glue theſe together, and bend both Moulds M, and N, round the Rail; ſtrike them by that, and cut the Wood away; ſo will the Back of your Rail be exactly ſquare.

YOU are to obſerve, the foregoing PLATE muſt be well underſtood, and then, in this PLATE, the Lengths of the Newel, and Balluſters are truely deſcribed; and that it may prove eaſy, obſerve, the Plan of the Twiſt or Scrole is the ſame as before, and ſo is the two Steps P, and Q, and the Pitch-Board R.

Firſt, reſolve on the Bigneſs of your Balluſters, as a, b, c, d, e, f; and the Newel on a Line in the Middle of the Rail. Divide the ſaid Balluſters truly; for what is wide on one Side, is narrower on the other. Therefore I chuſe to divide them on a middle Line. Deſcribe the Plan of the Balluſters, as p, q; r, s; t, v; u, w; x, y; and z; for there your twiſted Part ends; from thence to the Eye is level.

Obſerve where your Scrole begins, as at l; and on ſome Line, as above, firſt, make a Point at l; then from your Plan take the Diſtances p, q; r, s; t, v; u, w; x, y; and z: Which transfer, as above, obſerving to have regard to place truely each Diſtance from l, both Ways, as p, q; r, s; t, v; u, w; x, y; and z.--- Obſerve alſo, to take from the Plan the Diſtance from l, to m, which apply to the Pitch-Board R, from h, to n, which gives the Length h, o; take this Pitch-Board, and apply it on the Line above, which by Inſpection the Letters will ſhew; this gives the Slope of the Rail. From o, to h, and from h, to y, form the Curve by equal Diviſions, and drawing ſtreight Lines, as was before ſhewn.

Laſtly, having the Lengths of your fix'd Balluſters, as a, b, deſcribe the Step S; and alſo with the Pitch-Board deſcribe the Step T: So that by continuing perpendicular Lines, from the Points on the Line firſt terminated, to the ſaid Curve, and to the Steps, you have the accurate Lengths of the Balluſters, a, b, c, d, e, f, the Newel g, being the ſame Length as f, becauſe at f, or z, the twiſted Part ends,

The Curve of the firſt, or Curtail-Step P, is form'd by the ſame Rule as deliver'd for the Plan of the Rail.

It may not be amiſs here to obſerve, that I do not doubt, but that every one will allow, by obſerving the Point of the Sweep, or Curve's Beginning, and being particular in its Application, this, and the foregoing, tho' repreſented with but two Steps, is the ſame in Fact, as tho' I had deſcribed a whole Flight, to ſhew its Uſe.

Plate Y.

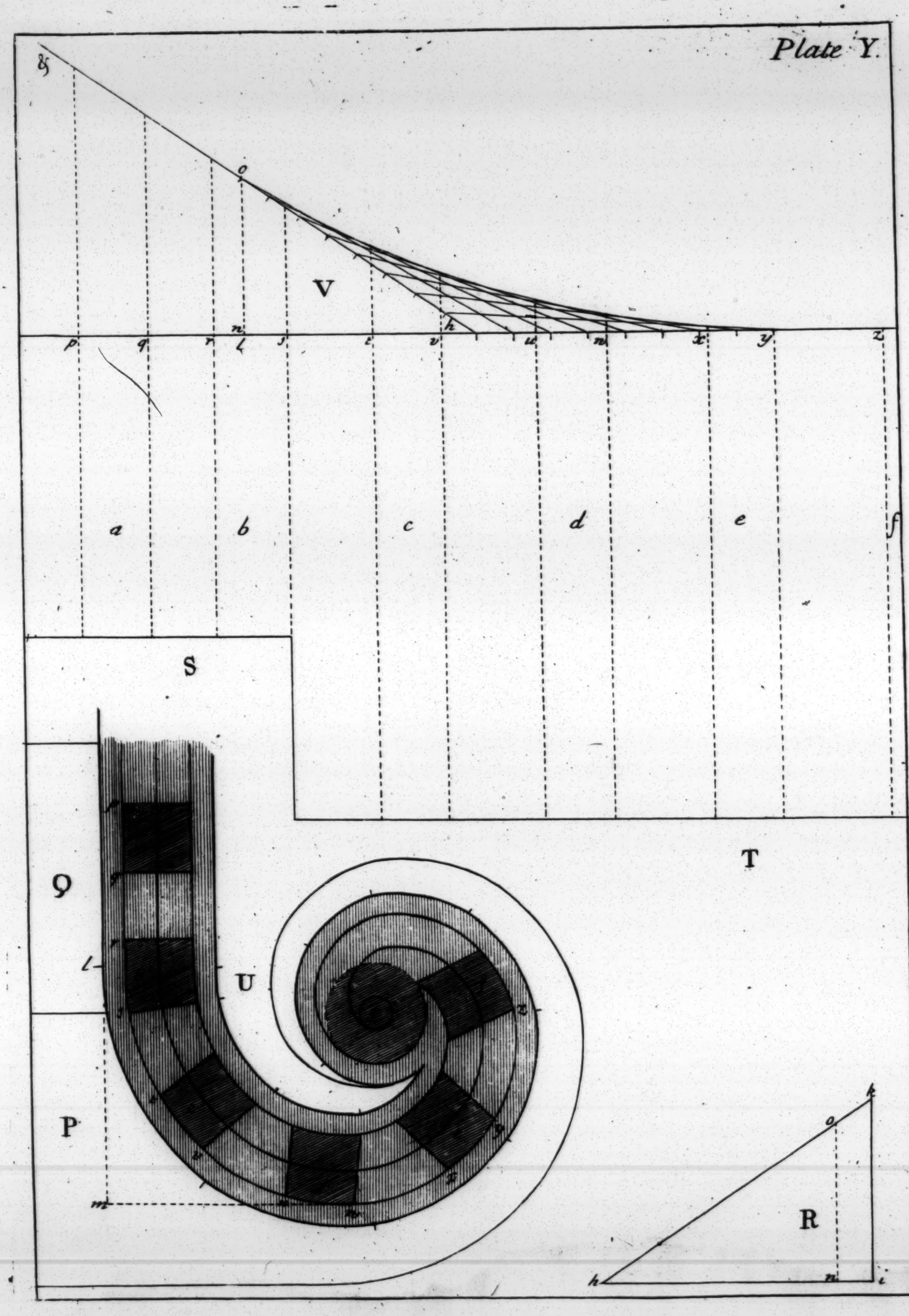
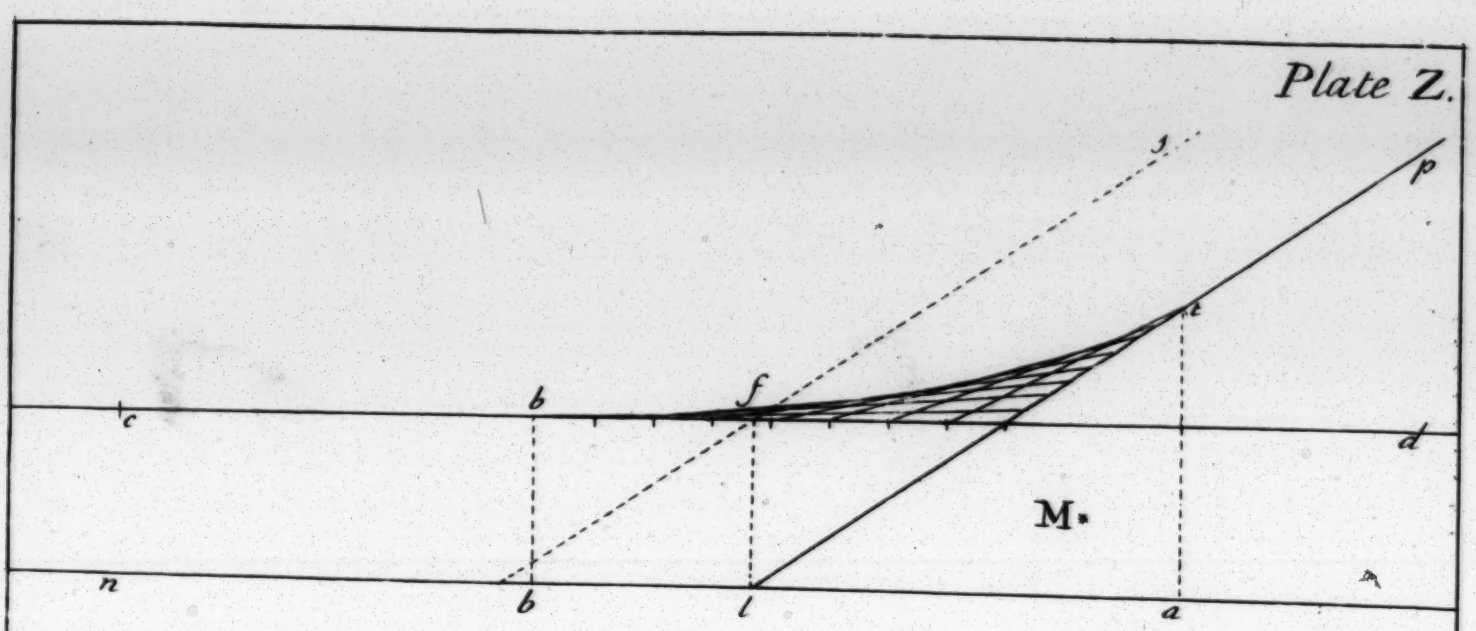
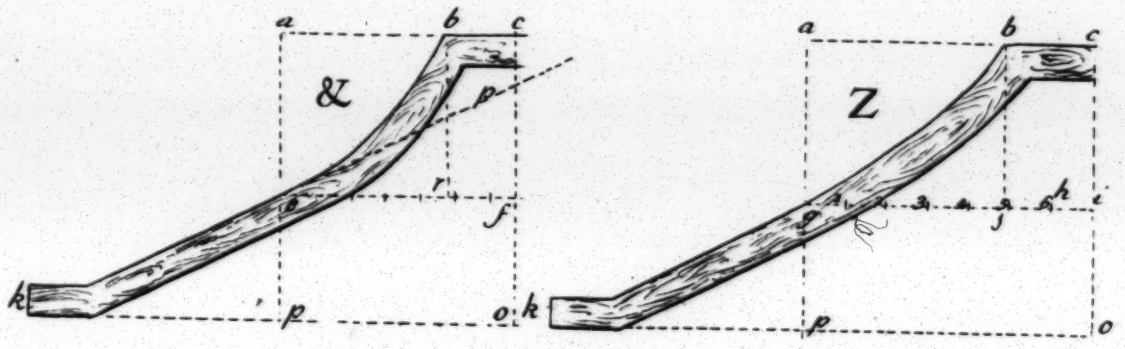
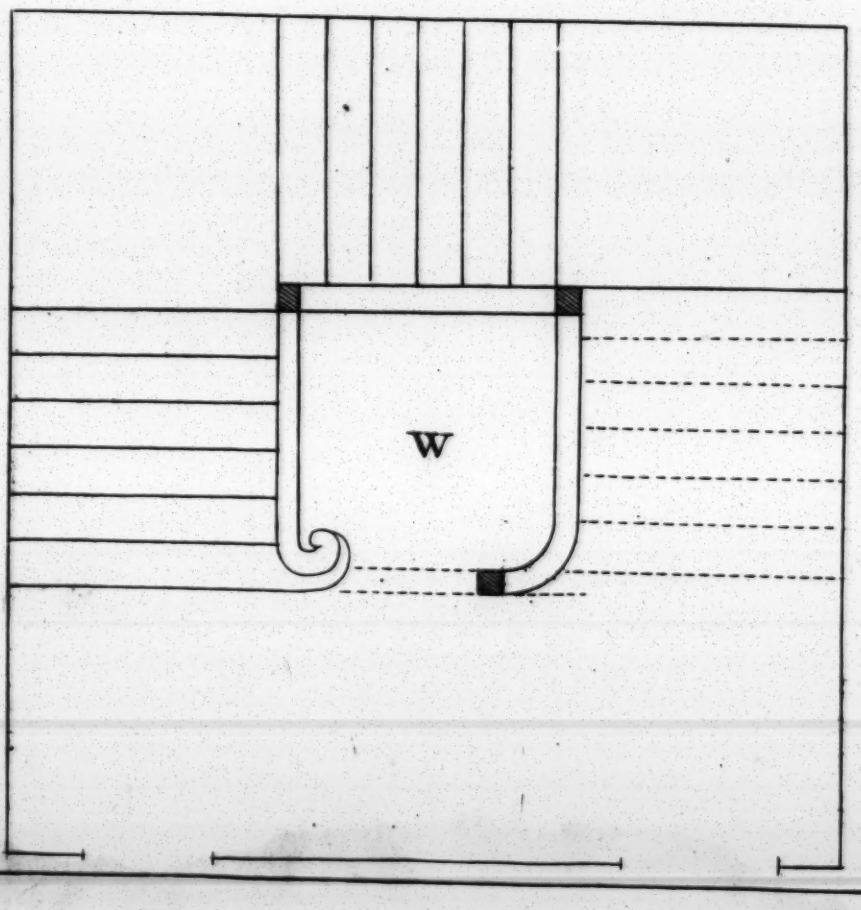
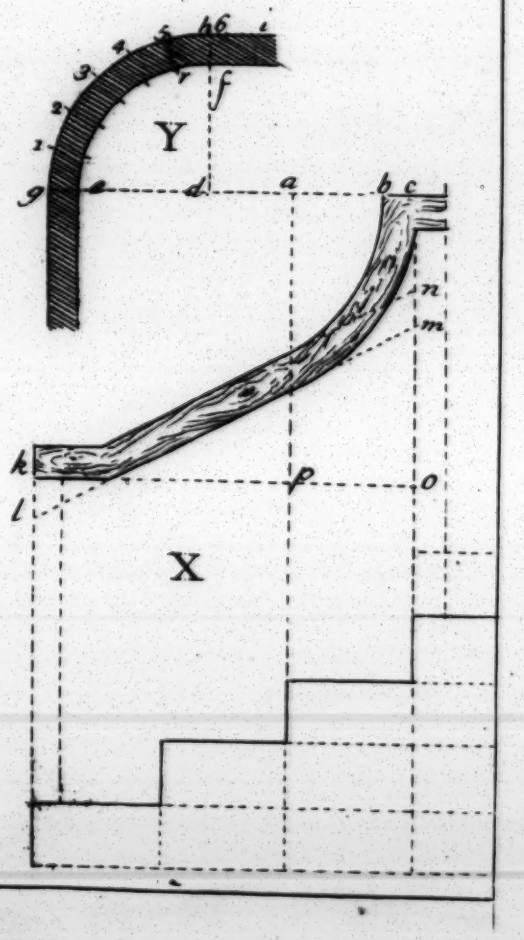


Plate Z.









ZEALOUS to promote what may be uſeful, in this PLATE I have made eaſy the Difficulty of Squaring a Rail that Ramps on a Circular Baſe.

Obſerve, W, is the Plan of a Stair-Caſe; and at the Landing is a Quarter-Circle: To make this eaſy; in X, by a larger Scale, is three Steps, deſcribed by the ſame Method as ſhewn in PLATE V. Likewiſe in Y, is the Plan of the Rail. It was ſhewn in PLATE X, how to trace out a Mould on the Rake, agreeable to this Plan, or indeed any other. A conſiderable Thickneſs is required on the Back of this Rail, as in &, at p, b; which will appear more plain by inſpecting PLATE X: As alſo the Method to trace your Moulds that ſhall bend round the ſaid Rail. Let the Sides be ſquared as was ſhewn in PLATE X. Here in Figure X, obſerve the Line k, p, o; take the Diſtance k, p, and place it on ſome Line, at pleaſure, as in Z; then divide the outer Circle in Y, into a Number of equal Parts, as into ſix, as from g, to h, which transfer to Z, as g, 1, 2, 3, 4, 5, 6, h. The Point of the Ramp may be obſerv'd to fall within the fifth Diviſion, as at s, by the Interſection of ſtreight Lines, and equal Diviſions. Deſcribe the Sweep for the Ramp g, b, which makes Z, the Mould to bend round the ſaid Rail.

Alſo in Y, from b, to f, divide into ſix equal Parts, which transfer to &, as from e, to f; and obſerve again the Ramp falls within the fifth Diviſion, as at r. So divide the Diſtance from e, to g, and from g, to b, into equal Parts, and by drawing ſtreight Lines, you have the Sweep b, e. From the Point b, to p, is the Thickneſs you want to be added on the Back of the Rail, &, which is the Inner-Mould; ſo that by bending both theſe Moulds round the Rail, you have an exact Square Back, by drawing by the Mould with a Pencil, and cutting away the Wood. --- There ſeems no Difficulty now left, unmentioned, to Square Twiſted Rails in any Form whatever.

Becauſe I have all along ſtrove to give Variety, obſerve M *; in which is ſhewn a Method to have your Newel under the Twiſt, the ſame Length as the reſt; by which means alſo the Rail twiſts no farther than the firſt Quarter, and conſequently the remaining Part may be cut out of a Plank, the Thickneſs of your Rail, without Twiſting. There ſeems no Explanation wanting to clear this Point, but Inſpection, and a good Conception of PLATE X: In this of M *, l, f, is the Thickneſs of Wood wanting on the Back of the Rail.

A TABLE *for the Scantlings of Timber.*

A Proportion for Timbers for ſmall Buildings.

Bearing Poſts of Fir	
Height	Scantling
if 8 Feet	4 Inch. Sq.
10	5
12	6

Bearing Poſts of Oak	
Height	Scantling
if 10 Feet	6 Inch. Sq.
12	8
14	10

Girders of Fir		
Bearing	Scantling	
if 16 Feet	8 I. by 11	
20	10	12 ½
24	12	14

Girders of Oak		
Bearing	Scantling	
if 16 Feet	10 I. by 13	
20	12	14
24	14	15

Joiſts of Fir		
Bearing	Scantling	
if 6 Feet	5 In. by 2 ½	
9	6 ½	2 ½
12	8	2 ½

Joiſts of Oak		
Bearing	Scantling	
if 6 Feet	5 Inc. by 3	
9	7 ½	3
12	10	3

Bridgings of Fir		
Bearing	Scantling	
if 6 Feet	4 In. by 2 ½	
8	5	2 ¼
10	6	3

Bridgings of Oak		
Bearing	Scantling	
if 6 Feet	4 Inc. by 3	
8	5 ½	3
10	7	3

Small Rafters of Fir		
Bearing	Scantling	
if 8 Feet	3 ½ I. by 2 ½	
10	4 ½	2 ½
12	5 ½	2 ½

Small Rafters of Oak		
Bearing	Scantling	
if 8 Feet	4 ½ In. by 3	
10	5 ½	3
12	6 ½	3

Beams of Fir, or Tyes		
Length	Scantling	
if 30 Feet	6 In. by 7	
45	9	8 ½
60	12	11

Beams of Oak, or Tyes		
Length	Scantling	
if 30 Feet	7 In. by 8	
45	10	11 ½
60	13	15

Principal Rafters of Fir, ſcantling		
Lgth.	Top	Botm.
if 24 ft.	5 I. & 6	6 I. & 7
36	6 ½ 8	8 10
48	8 10	10 12

Principal Rafters of Oak, ſcantling		
Lgth.	Top	Botm.
if 24 ft.	7 I. & 8	8 I. & 9
36	8 9	9 10 ½
48	9 10	10 12

A Proportion for Timbers of large Buildings.

Bearing Poſts of Fir	
Height	Scantling
if 8 Feet	5 Inch. Sq.
12	8
16	10

Bearing Poſts of Oak	
Height	Scantling
if 8 Feet	8 Inch. Sq.
12	12
16	16

Girders of Fir		
Bearing	Scantling	
if 16 Feet	9 ½ I. by 13	
20	12	14
24	13 ½	15

Girders of Oak		
Bearing	Scantling	
if 16 Feet	12 I. by 14	
20	15	15
24	18	16

Joiſts of Fir		
Bearing	Scantling	
if 6 Feet	5 Inc. by 3	
9	7 ½	3
12	10	3

Joiſts of Oak		
Bearing	Scantling	
if 6 Feet	6 Inc. by 3	
9	9	3
12	12	3

Bridgings of Fir		
Bearing	Scantling	
if 6 Feet	4 Inc. by 3	
8	5 ½	3
10	7	3

Bridgings of Oak		
Bearing	Scantling	
if 6 Feet	5 In. by 3 ½	
8	6 ½	3 ½
10	8	3 ½

Small Rafters of Fir		
Bearing	Scantling	
if 8 Feet	4 ½ In. by 3	
10	5 ½	3
12	6 ½	3

Small Rafters of Oak		
Bearing	Scantling	
if 8 Feet	5 ½ In. by 3	
10	7	3
12	9	3

Beams of Fir, or Tyes		
Length	Scantling	
if 30 Feet	7 In. by 8	
45	10	11 ½
60	13	15

Beams of Oak, or Tyes		
Length	Scantling	
if 30 Feet	8 In. by 9	
45	11	12 ½
60	14	16

Principal Rafters of Fir, ſcantling		
Lgth.	Top	Botm.
if 24 ft.	7 I. & 8	8 I. & 9
36	8 9	9 10 ½
48	9 10	10 12

Principal Rafters of Oak, ſcantling		
Lgth.	Top	Botm.
if 24 ft.	8 I. & 9	9 I. & 10
36	9 10	10 12
36	10 12	12 14

Remarks

ALTHO' this Table ſeems ſo plain as to need no Explanation, and in which are ſhewn the Scantlings of moſt Timber that can (or may) be brought to a certain Rule or Proportion;

I ſay, notwithſtanding its Plainneſs, it may not be amiſs to obſerve ſome Particulars, which by mere Inſpection do not appear; ſuch as that all Binding or Strong-Joiſts ought to be half as thick again as Common-Joiſts; that is, if a Common-Joiſt be three Inches thick, a Binding-Joiſt ſhould be four Inches and a Half thick, altho' the ſame Depth.

Obſerve alſo, that if Conveniency do not allow of Poſts in Partitions being ſquare, in ſuch Caſes, multiply the Square of the Poſts by itſelf: For Inſtance, ſix Times ſix is thirty ſix, then conſequently to keep this Poſt nearly to the ſame Strength, find ſome Number that ſhall agree thereto; as ſuppoſe the Partition to be four Inches thick, then let your Poſt be nine Inches the other Way, ſo that nine Times four is thirty ſix, and is the ſame as ſix Times ſix; ſo that the Strength is nearly the ſame, altho being equal in its Squares is beſt for the Strength.

I do not inſiſt that the Scantlings of Timber ought to be exactly as by this Table is expreſs'd, but may be varied in ſome Reſpects; the Reaſon of its being inſerted is in conſideration of the Scantlings of Timber, as formally ſettled by Act of Parliament, and which if compared, will prove the Neceſſity, and Uſe of this Table.

As to Plates on Walls, or Breſt-Summers to ſupport Walls, I do not find they can come into any regular Proportion, as the reſt do.

FINIS.

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